Upper Assiniboine River Basin Study

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Upper Assiniboine River Basin Study

Appendix C

Wetlands Committee Report

August 2000

Executive Summary

The Wetlands Committee members represented Saskatchewan, Manitoba and Canada, and non-government conservation interests in a variety of disciplines related to wetland resource management. The purpose of the Committee was to provide information relevant to wetland management in the Upper Assiniboine River Basin. The objectives were to describe wetland resources in the Basin, how they have changed over time and the benefits of these resources. Upland resources are also described because of their close association with wetlands. The discussion of wetlands and uplands in this report is intended to be used at a general planning level. The wetland resources of a specific area require further assessment for more detailed watershed plans.

Wildlife use of wetland and upland types were described through a literature review. The distribution and extent of wetlands and uplands was estimated from satellite imagery classification. Annual aerial and ground survey results were analysed to describe the abundance of wetlands, waterfowl populations and effects of cyclic precipitation and land use practices on wetlands and uplands. Available agricultural census data and aerial photo studies provided information on the effects of land use change on wetlands and native uplands. Social and economic considerations related to wetland and native uplands were discussed.

Temporary and seasonal wetlands are the most common types in the Basin. They are as important for wildlife breeding and foraging as are as more permanent wetlands. Cropland is the most abundant upland habitat followed by woodland, native grassland and pasture. Hayland is relatively uncommon. The Basin supports a diversity of wildlife, about 240 bird species, 50 mammal species, three reptile and five amphibian species. The Basin is an important area for waterfowl in prairie Canada. Waterfowl populations have fluctuated from about 200,000 to 800,000 in the Basin over the last 40 years depending on the availability of water. Land use change as reported by agricultural census statistics showed that 65 percent of the Basin was in crop production in 1996 compared to 51 percent in 1956. In 1956, 44 percent of the land area was reported as unimproved compared to 24 percent in 1996. Aerial photo studies showed that in some areas an average of 45 percent of the wetland acreage has been removed. Temporary and seasonal wetlands are most impacted by agricultural activities. Ground study transects showed that in some areas up to 75 percent of the temporary basins and up to 80 percent of their margins were cultivated.

Wetlands and native uplands provide a source of domestic water, livestock watering and forage, recreational activities, and non-consumptive uses such as hunting, trapping and fishing. They also help to control erosion. Wetlands also recycle, mobilize and concentrate nutrients.

Recommendations are provided as considerations for managing wetland and upland habitat in the Basin. Watershed plans should be developed as a basis for designating lands for development and for conservation purposes. Criteria are needed to assist landowners in planning and resource managers in evaluating and approving proposed wetland drainage and upland habitat removal.

Information and extension programs are needed to increase awareness of the importance of wildlife habitat and to implement land use activities that will benefit both agriculture and wildlife. Compensation and mitigation to encourage wetland and wildlife habitat retention can be effective components of watershed management. A process is suggested to implement watershed plans. Pilot projects are recommended to implement watershed planning and apply information developed for the Study.

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1 Introduction

Located between prairie and boreal forest, the Upper Assiniboine River Basin (UARB) is typically characterized as aspen parkland. The history of glaciation together with vegetation succession and climate have resulted in generally undulating topography with rich soils. Steeper valleys are found along the Assiniboine and Shell rivers. Aspen groves and wetlands dot the landscape. The climate and soils are favourable for agriculture. During land settlement, trees were cleared and sloughs were drained to enable agricultural use for growing grains and seeding tame forage. As equipment improved, land clearing became more extensive. The availability of larger earth movers also served to drain wetlands, fill depressions, and contour land. Most regions of the Study area have experienced some degree of clearing and drainage.

Drainage of land has resulted in conflicts between neighbours, between landowners and regulatory agencies and between landowners and conservation interests. Some landowners downstream of land that has been drained have found their land subjected to increased flood water, either by a greater volume or an increased frequency. Some landowners may not have appropriate approvals to drain their land putting them in conflict with provincial regulatory agencies. Landowners may use existing legislation to try to resolve complaints about flooding of agricultural land.

Concerns have been expressed about loss of wetlands and alteration of adjacent native habitat across the Prairies. An estimated 50 percent of the potholes in the central prairies no longer exist (Environment Canada 1991). About 40 percent of the wetlands in the agricultural area of Saskatchewan have disappeared resulting in a reduction in habitat for waterfowl, songbirds and other migrant and resident birds (Saskatchewan Wetland Conservation Corporation 1993). Also affected are wildlife populations such as birds of prey, reptiles, amphibians, fish, and mammals that depend on these habitats.

Many conflicts, concerns, and risks are associated with reduction and retention of wetlands and adjacent upland habitat. The Upper Assiniboine River Basin Study's Management Committee identified a need to provide direction for future management of the wetland resources in the Basin.

1.1 Formation of the Wetlands Committee

Agencies with an interest in wetland resource management were invited to form the Wetlands Committee in 1997. The committee developed terms of reference in June of that year. The primary purpose of the committee was to provide information relevant to wetland management in the Basin. The committee's terms of reference are provided in Figure 1.1.

Figure 1.1
Wetlands Committee Terms of Reference

Objectives:

1) To describe the wetland resources in the Upper Assiniboine River Basin.
2) To describe how wetland resources in the Basin have changed over time.
3) To describe the uses and the economic values of wetlands in the Basin.
4) To develop wetland management objectives for the Basin.
5) To develop strategies for achieving these objectives.

Activities:

1)
    a) Describe the uses of wetlands in the Basin.
    b) Describe wetland benefits/values including waterfowl and other species as well as hydrological and ecosystem values.

2) Synthesize information on wetland resources in the Basin.
    a) Describe current resources by synthesizing available information on wetland habitat and waterfowl numbers.
    b) Describe changes observed over the time period of surveys.
    c) Coordinate description of wetland habitat with classification to be done by the Water Supply and Use and Drainage and Flood Control Committees.
    d) Describe the value of the habitat in the Basin in a regional context (Saskatchewan and Manitoba) and in a North American context.

3) Describe current (existing) and anticipated (proposed) wetland and related conservation land designations, purchases, easements and leases in the Basin.

4) Develop wetland management objectives for the Basin.
    a) Describe existing wetland management objectives (governments, conservation organizations).
    b) Describe current government role including policy, programs and legislation related to wetland management.
    c) Design a process to involve interested people in developing wetland management objectives for the Basin.

5) Identify strategies that will assist in meeting Basin wetland objectives.

The committee gathered, synthesized and analyzed information on land cover and wetlands in the Basin; contracted a literature review on wildlife and wildlife habitat in the Basin; and described the results of its work in this report. Reports specifically prepared for the committee were Wildlife Utilization of the Upper Assiniboine River Basin: Presence, Abundance and Value (Wapple 1999, see Appendix I) and Habitat Trends in the Upper Assiniboine River Basin: Canadian Wildlife Service Habitat Monitoring (Didiuk 1999, see Appendix II).

Numerous resource management agencies have supported the work of this committee including representatives with expertise in biology, ecology, water management, agricultural economics, wildlife management and conservation. Members represent provincial and federal government and non-government conservation agencies. These agencies supported the committee's work and the Study by participating in open houses, presenting information to the local watershed committees, preparing data and other information, supervising Study contracts, and participating in committee meetings. The Study contributed funds to the Canadian Wildlife Service to compile data collected on breeding waterfowl surveys and habitat evaluations, and a study to collate information on wildlife and wildlife habitat. Ducks Unlimited contributed to mapping and classifying wetlands in the Basin. The committee's work was supported by the GIS Committee and the Drainage and Flood Control Committee.

2 Study Approach

The Wetlands Committee first identified issues and concerns expressed by the public and resource managers. Committee members then identified information available to address the issues. Work was undertaken by committee members' agencies and consultants to compile and analyze this information. The Committee used existing information rather than undertaking additional field work.

The basic issue in the Upper Assiniboine River Basin relating to wetland habitats is conflict between developing and utilizing the land for agriculture and conserving the land and water for wildlife.

Drainage of wetlands, breaking of native grasslands, and clearing of trees have been vital in the development of agricultural lands in both Manitoba and Saskatchewan. There has been a movement towards increasing the size of farms, using larger equipment, and increasing efficiency by maximizing cultivated acreage. Clearing land and draining and filling wetlands enable more efficient use of larger farm machinery, and increase cultivated acreage.

Some agricultural producers want to further develop land to increase its suitability for annual crop production. Because many wetlands are either temporary or semi-permanent, agricultural producers may perceive these wetlands as unproductive for both agriculture and wildlife.
The development of drainage works enables the removal of excess surface water. This is beneficial, particularly in wetter springs, because with a short growing season an earlier seeding date decreases the likelihood of frost damage to crops. A high proportion of these wetlands may be easily drained because of the topography and their proximity to an outlet.

The Basin contains wetland habitats that are considered significant for waterfowl from a continental perspective and for other plant and wildlife populations. Land clearing and wetland drainage have resulted in the loss of waterfowl and wildlife habitat and fragmentation and isolation of remaining habitats. The result is loss of wildlife breeding habitat, cover and travel corridors. There are concerns that wildlife populations are being adversely affected because of the deterioration and loss of habitat. Similar concerns are being raised about the status of the biodiversity of the Basin. Some agricultural producers have expressed a concern about the potential for a focus on environmental values and that this may affect their ability to further develop land.

2.1 Issues

During the open houses and local watershed committee meetings, people who live in the Basin discussed their concerns about wetlands and wetland management. As well, resource managers from government agencies and conservation organizations identified problems and concerns about wetlands and upland habitat management. The Wetlands Committee felt that there was an overall lack of understanding of wetlands and their role within the ecosystem. Seven issues were identified to direct the work of the committee.

2.1.1 Current Status of Wetland and Upland Habitat

At the beginning of this Study, all that was known about the Study area was that it was generally rich in wetland and upland habitats. To arrive at any conclusions or recommendations, the committee felt it is important to know the current status of both upland and wetland habitats within the entire watershed.

2.1.2 Importance of Wetlands and Uplands in the Upper Assiniboine River Basin

Waterfowl are an obvious and important group of wildlife that depends on wetlands. As well, wetlands and their associated uplands provide habitat for a wide range of plants and animals. The Basin is located in a transition zone between the prairie and boreal forest ecozones often referred to as aspen parkland. Therefore, a greater variety of species can be expected to be living in the Study area. A number of questions were raised about the importance of wildlife habitat in the Basin. The need was identified to describe the wildlife that live in the Basin and to understand the importance of wildlife habitat associated with wetlands in the Basin. Questions were asked about the importance of wetlands in the Basin with respect to the larger region of Saskatchewan and Manitoba and ultimately within prairie Canada.

2.1.3 Natural Variations in Wetland Abundance and Quality

Wetlands are not uniformly distributed across the Basin. The location, size and type of wetlands are the result of a number of factors. Among these are the influence of glaciation which resulted in various kinds of surficial material deposits and varying sizes of depressions. Subsequent vegetation and succession of plant communities have influenced the wetland characteristics. As well, precipitation is variable and cycles of several years of drought and high water conditions occur. This directly affects the numbers and types of wetlands. During years of high precipitation, wetlands fill and overflow; during low precipitation water levels are low and thus there are opportunities to drain and cultivate wetlands and their margins. People described the need to understand what factors influence a change in wetland abundance and quality in the Basin.

2.1.4 Change in Wetland Habitat Due to Land Use

For a number of years, wildlife managers and conservation interests have identified a trend in the reduction of wetland numbers. About one-seventh of Canada's wetlands have been drained or lost to other functions. About 65 percent of Atlantic coastal salt marshes are gone, and 80 to 90 percent of wetlands adjacent to urban centres have been lost. Over 50 percent of the potholes in the central Prairies no longer exist (Environment Canada 1991). An estimated 40 percent of Saskatchewan's wetlands have disappeared since the time of settlement (Saskatchewan Wetland

Conservation Corporation 1993). Concerns have been expressed regarding the removal and degradation of the uplands associated with wetlands and riparian areas in the province. These areas are also at risk. People have raised a number of questions that need to be clarified to evaluate this risk. Among these are: What proportion of the wetlands in the Basin has been lost? What wetlands remain and which are most at risk?

Associated with wetlands and streams is a margin of plants, grasses, shrubs and trees. When land is cleared and sloughs are drained, the associated uplands are usually removed. Questions were raised about the type and extent of upland habitat that exists in the Basin. What is the trend in clearing of natural grassland and woodland in the Basin? What value are cropland and tame forage for wildlife?

2.1.5 Effects of Alteration and Loss of Wetlands on Wildlife

Some plant and animal species may be more vulnerable than others to loss and alteration of wetlands. Some species may be able to adapt, at least for a short period of time, through dispersal or use of other types of habitats. The removal or degradation of upland habitat, such as slough margins and riparian woodlands can also affect wildlife which use wetlands. Questions were raised about the effect on waterfowl, other animals and native plants by the reduction and change in wetlands and upland habitats in the Basin. Can isolation and fragmentation of wetland and upland habitat be problems in the Basin? Increasing concerns have also been expressed about the effects of reduced native habitat on species diversity in prairie Canada.

2.1.6 Economic and Social Considerations Associated with Wetlands

Landowners expressed a number of concerns about wetlands because they can interfere with agricultural operations. Some problems identified were flooding associated with wetlands, increased costs of working the land around wetlands, inconvenience of using larger machinery around wetland margins, weed growth in wetland margins, and the potential crop damage and losses from waterfowl attracted during fall migration. Numerous costs to individuals and society also result from the removal of wetlands. Some of these are increased erosion and downstream sedimentation, increased downstream flooding and reduced filtration by wetlands which in turn affect water quality.

Some landowners also voiced concerns about the amount of wildlife habitat that has been secured within the Basin by government and non-government agencies. Some landowners expressed the viewpoint that too much habitat has been secured, that agencies have unfair advantages because of larger financial resources, are paying above market value, and acquiring and thus removing productive farmland from agricultural use.

A need was identified for understanding these social and economic aspects associated with wetlands.

2.1.7 Resolution of Conflicts Between Land Use for Agriculture and Wildlife Habitat

Water and wildlife are Crown-owned natural resources. Conflicts arise, however, when these resources are located on private land. The goal of many agricultural producers is to improve land for annual cropping systems by clearing upland vegetation and draining wetlands. This goal conflicts with the goals of conservation and wildlife interests to conserve and improve wildlife habitat. There is no one solution that will allow some degree of agricultural expansion or development and still protect wildlife interests. Approaches are needed to enable these diverse interests to work together to achieve their respective goals.

2.2 Methods

The Wetlands Committee used existing information for this Study. No additional field work was undertaken specifically for the Study. Analysis and synthesis of this existing information was required. In addition, people who have an understanding and knowledge of the region and issues to be addressed were consulted. This section describes the methods that the committee used to obtain information.

2.2.1 Types, Abundance and Distribution of Wetland and Upland Habitat

2.2.1.1 Habitat Types

Ground surveys have been conducted by the Canadian Wildlife Service (CWS) throughout prairie Canada each year since 1981. These surveys are conducted along 28.8 km long transects where all wetlands within 200 m of each side of the road are counted and typed. Upland habitat types adjacent to these wetlands are also recorded. Within the Basin there are five ground survey segments: two with information from 1981 (Buchanan and Yorkton, Saskatchewan areas); one from 1982 (Penrith, Manitoba area); one from 1991 (Wroxton, Saskatchewan area); and one from 1992 (Nut Mountain, Saskatchewan area). Figure 2.1 shows the location of the ground surveys.

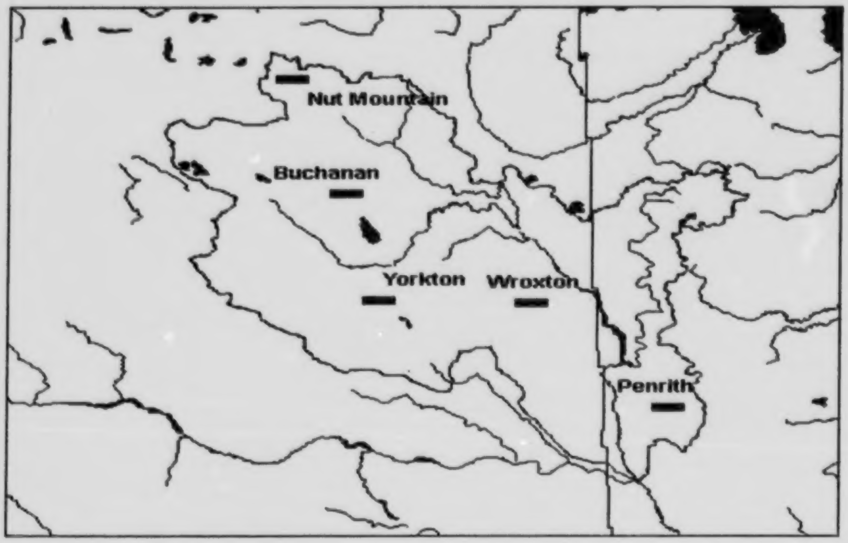
(1) Wetlands

These surveys provided a detailed assignment of wetland type, based on water permanence, for every wetland basin regardless of whether it contained any surface water at the time of survey (CWS 1989). The following wetland types are assigned, assuming a spring and early summer of average precipitation and temperature:

- dry basin: no surface water in basin
- temporary: maximum water depth of 15 cm; dry by end of May

- seasonal: maximum water depth > 15 cm to 1 m or more; surface water maintained to mid-July
- semi-permanent: maximum water depth > 1 m; in most years surface water maintained to freeze-up
- permanent: maximum water depth >> 1 m; dry after periods of extreme and prolonged drought.
- stream segment: portion of stream channel in segment with some surface water
- dry stream: no surface in stream bed
- artificial wetland: dugout, gravel pit, borrow pit, stock pond, reservoir, sewage lagoon, irrigation canal

Figure 2.1
Ground Transects of CWS in the Basin



The wetland classification uses the current year's water conditions for each basin inspected. This classification was highly variable among years due to variable spring run-off water from snow melt. The wetland type of a given basin could, and did, vary among years. To allow an assessment of wetland conditions and agriculture impacts a 'base type' was assigned to each basin from a review of the basin's annual classifications. This base type represented the most permanent water condition possible for each basin based on its survey history. The proportions of wetland types for five ground transects were calculated to indicate the range of variation of types of wetlands within the Basin.

There are two components associated with a given wetland:

a) Wetland Basin
The basin of a wetland was defined as the lowest area of the wetland up to the full supply level. This included the area to the outer edge of the wet meadow vegetation zone (based on plant species composition), and this limit was often evident by the presence of a border of moist site shrubs (willows). A variable portion of the area of the basin would be covered by water depending upon the spring water conditions.

b) Wetland Margin
The margin of a wetland was defined as the upland habitat, composed of natural vegetation, for the first ten metres beyond the outer limit of the basin. This ten metres width was selected as a margin "width" since intact margins were usually much less in width (due to cultivation) and this distance from the wetland basin was important from a biological view (high species diversity, important nesting habitat for waterfowl). The average width of the margin around the entire basin was visually estimated from zero to ten metres. If the wetland basin was surrounded by extensive vegetation beyond this ten metre distance, the margin was still recorded to be ten metre wide. The margin width of ten represented a value of at least ten metres.

The proportion of the area of the basin which was covered by woody vegetation (trees or shrubs, usually the latter) was also estimated visually. The proportion of the perimeter of the margin which contained woody vegetation was also estimated visually. The width of this woody vegetation, and whether is was composed of trees or shrubs, was not evaluated.

(2) Uplands

Eight upland habitat types were assessed within the Basin, based on categories used during the annual ground surveys by the Canadian Wildlife Service: crop, stubble, summer fallow, hayland, native pasture, woody pasture, native grassland, and woody vegetation. Additional habitat types in the Basin, not included in these spring surveys, include riparian habitat along streams and lakes.

2.2.1.2 Abundance of Wetland and Upland Habitat

(1) Wetlands

(a) Aerial Surveys
The Canadian Wildlife Service (CWS) and the United States Fish and Wildlife Service (USFWS) have conducted aerial surveys in prairie Canada since the 1950s (CWS and USFWS 1987).

These surveys are conducted annually in May throughout the agricultural areas of Alberta, Manitoba and Saskatchewan to provide an index to the number of waterfowl in the May breeding period. Surveys are conducted along east-west transects and each transect is comprised of a variable number of contiguous 28.8 km segments. The number of ponds along the pilot's side of the aircraft is recorded, excluding shallow water or temporary wetlands. Although the coverage of this survey is comprehensive in geographic scope, the relatively low sampling intensity and high spatial variability of waterfowl populations and wetlands result in this survey data are being best used as an index to populations rather than absolute estimates with low estimates of variation. This design and type of survey data were, and are, appropriate for monitoring trends of waterfowl species for use in harvest regulation.

Within the Basin there are 10 survey segments associated with portions of six of the transects (Figure 2.2). These surveys have been conducted since 1962. These data were collated for the strata 31 and 34 in Saskatchewan and the western portion of stratum 37 in Manitoba. As well, the number of wetlands counted for the 10 segments within the Upper Assiniboine River Basin was compiled. These data provide a measure of abundance of wetlands within east-central Saskatchewan and western Manitoba, and within the Basin, over time.

(b) Satellite Image Counts

LANDSAT satellite imagery from a 1994 scene of the Basin was analyzed by Ducks Unlimited. Land cover classes mapped included open water, deep marsh, shallow marsh, wet/dry marsh, and mud flat. This information was used to calculate the amount of different types of wetlands in the study area.

(2) Uplands

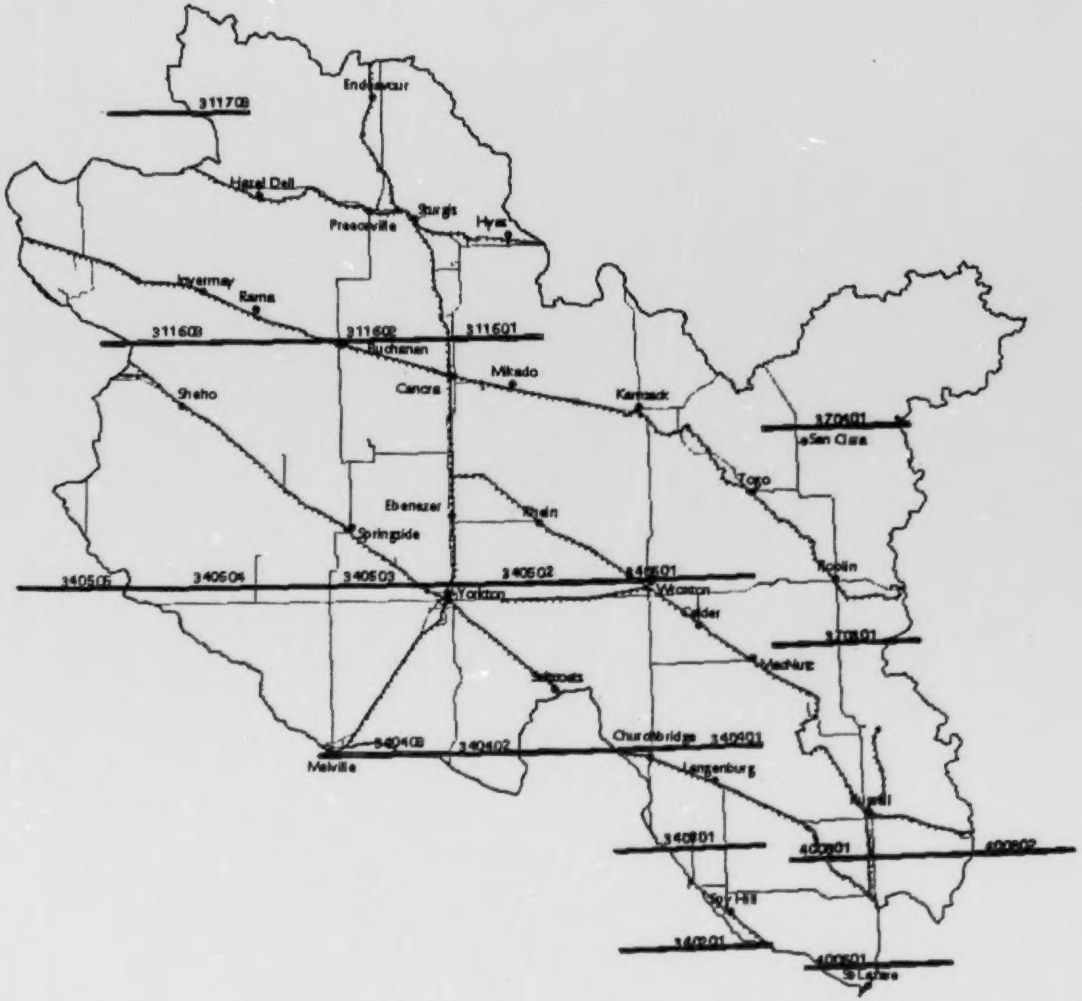
(a) Ground Surveys

The Canadian Wildlife Service annual ground counts of wetlands also assess the proportion of different upland habitats adjacent to wetlands. The types of upland habitat away from wetlands and their margins were assessed by estimating the proportion of each upland habitat abutting the perimeter of each margin. The cumulative proportion of upland along these wetland margins was an effective surrogate measure of actual area (D. Tide, pers. comm. University of Saskatchewan). These estimates provided a description of the range of proportions of each upland type within the Basin.

(b) Satellite Imagery

LANDSAT satellite imagery of the southern prairies was acquired from the Western Grains Transition Payment Program (WGTPP). This imagery was interpreted and used to classify land cover for the Basin. Upland habitat types included cropland, forage, grassland, shrubs and trees.

Figure 2.2
Aerial Transects in the UARB



2.2.1.3 Distribution of Wetland and Upland Habitats

(1) Wetlands

(a) Aerial Surveys
The Canadian Wildlife Service and United States Fish and Wildlife Service annual spring surveys provide data regarding the distribution of wetlands throughout prairie Canada (CWS and USFWS 1987). Contour maps of wetland density were prepared, using these annual data, to depict the variation in distribution of wetlands within east-central Saskatchewan and west-central Manitoba, and the Basin.

(b) Satellite Imagery
The satellite imagery classified by Ducks Unlimited provided a map of wetland distribution throughout the Basin. Wetland types (open water, deep marsh, shallow marsh, wet/dry marsh, mud flat) were combined to depict the relative density of wetland basins throughout the Basin. Figure 2.3 is an example of a satellite image used to classify wetlands and uplands.

(2) Uplands

(a) Satellite Imagery
The satellite imagery provided by WGTTP provided a map of upland cover types throughout the Basin.

(3) Habitat Quality

Different species of wildlife use different types of wetland and habitat types, and many species use several habitat types during the year (e.g., seasonal wetlands for breeding, native grasslands for foraging). It is a challenge to depict, in a single map, both the abundance and the importance of the various types of habitat throughout the Basin. Given the extensive loss of most types of native vegetation and many wetlands, and the continued loss of these habitats, the basic premise used to assess distribution and value of wildlife habitat was "more is better". A given area with large amounts of native vegetation and wetlands was considered to be of the highest value for wildlife, whereas a given area with little or no native vegetation or wetlands was considered to be of the lowest value for wildlife.

The percentage of wetlands, and the percentage of native vegetation (native grassland, shrubs, and trees), were calculated for each quarter section of the Basin. Each quarter was assigned a colour on a map of the Basin based on the proportion of wetland and upland habitat as shown in Figure 2.4.

Figure 2.3
Satellite Image in the Upper Assiniboine River Basin

Landsat TM Bands 3,4,5

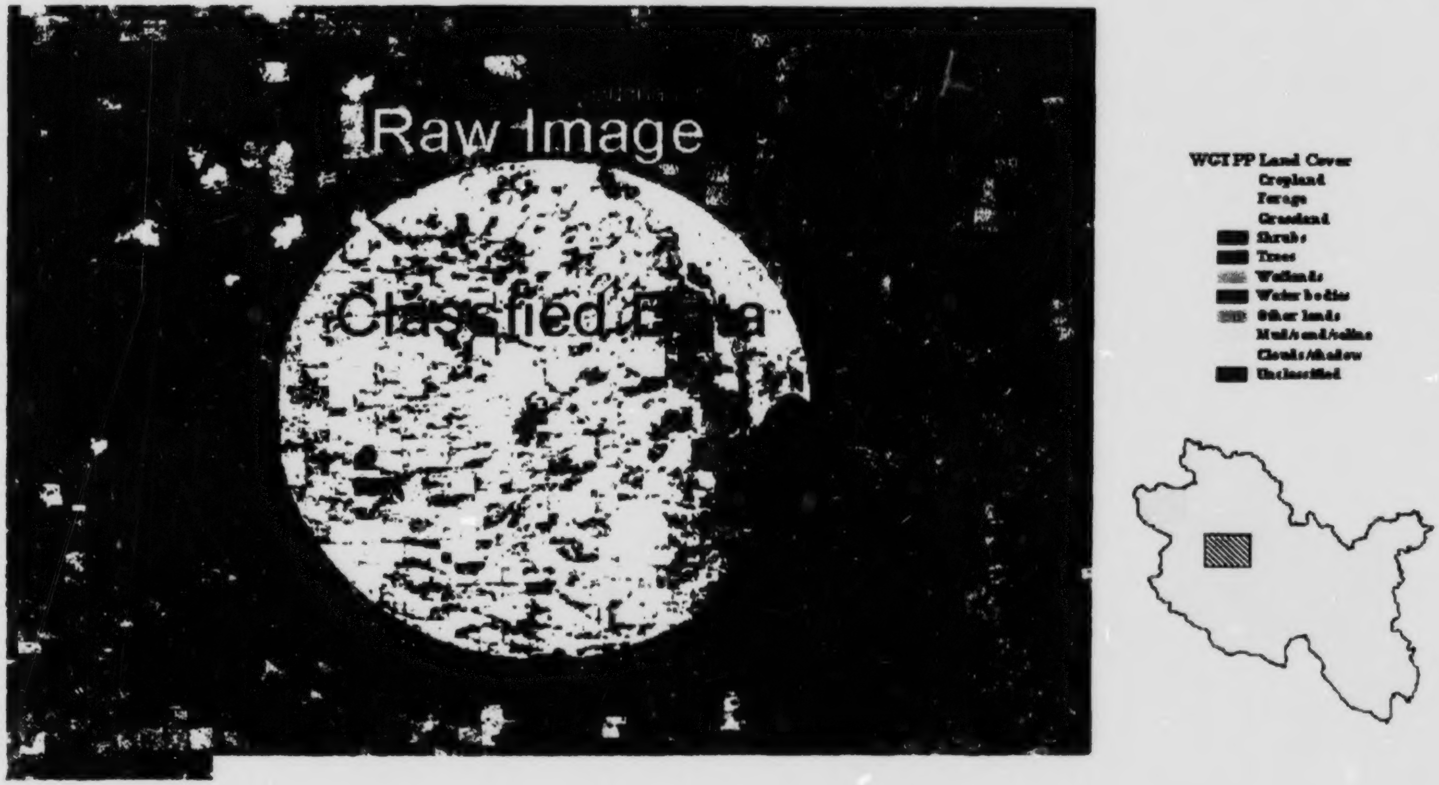
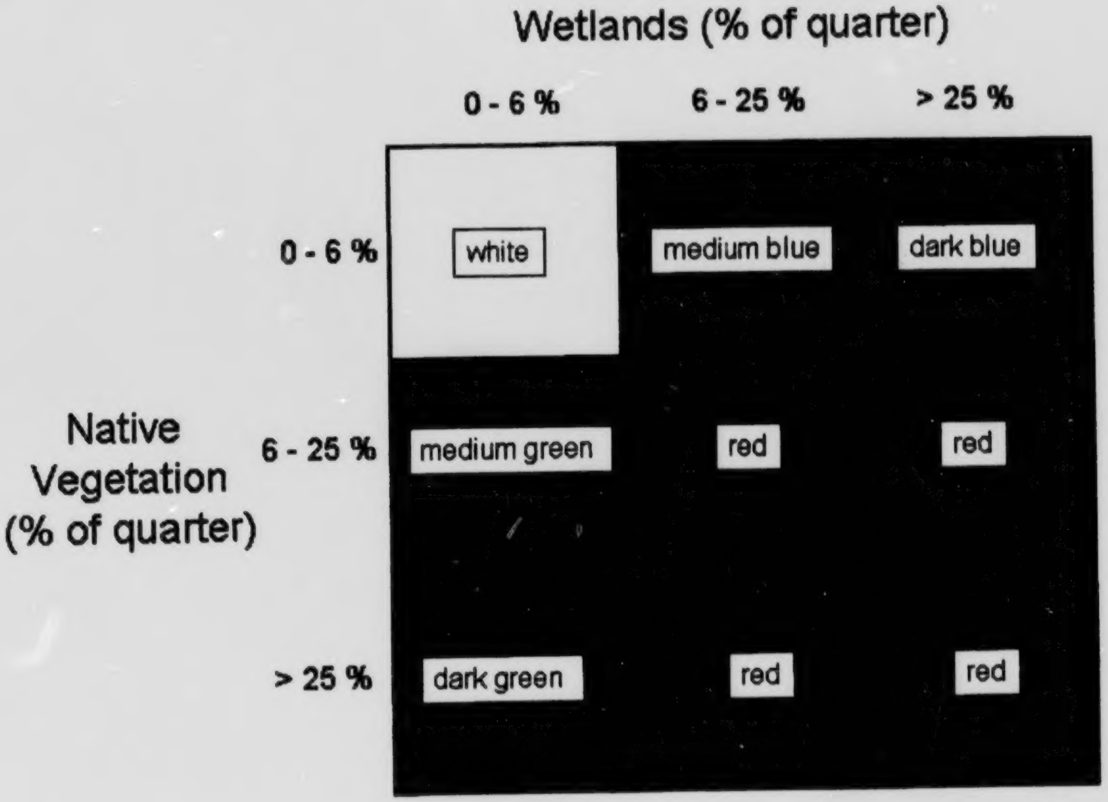


Figure 2.4
Colour Matrix Used to Classify Habitat Proportions



Native Vegetation (% of quarter)	Wetlands (% of quarter): 0 - 6 %	6 - 25 %	> 25 %
0 - 6 %	white	medium blue	dark blue
6 - 25 %	medium green	red	red
> 25 %	dark green	red	red

For example, a quarter section which had greater than 25 percent wetlands, and 25 percent native vegetation was considered to be of high value (red). A quarter section which had 0 to 6 percent wetlands, and 0 percent to 6 percent native vegetation was considered to be of low value (white). A quarter section with greater than 6 percent to 25 percent wetlands, and greater than 6 percent to 25 percent native vegetation was considered to be of medium value. The colours in this matrix indicated whether wetlands were most abundant (blue), native vegetation was most abundant (green), or both were abundant (red).

This map allows the identification of general regions within the Basin which have greater abundance of high value wildlife habitat (more wetlands and native vegetation). These areas were identified as distinct areas with varying value of combined wetland and upland habitat for wildlife. This map can be integrated with soil capability and other data bases to determine risk These maps can allow an assessment of risk to habitat with given land use scenarios at a scale sufficient for detailed sub-basin analyses or for the entire Basin.

2.2.2 Importance of Wetland and Upland Habitats for Wildlife

A review of the literature was conducted to provide a description of the physical characteristics and vegetation of the different wetland and upland habitat, and the use of different types of wetlands and uplands by birds, mammals, amphibians, and reptiles for breeding, foraging and other seasonal activities (Wapple 1999). This literature review also described the occurrence of rare, threatened or endangered species of flora and fauna with the Basin, and the habitat types they utilize.

Spring waterfowl aerial survey data (CWS and USFWS 1987) allowed a comparison of the numbers and trends of waterfowl which breed within the Basin relative to east-central Saskatchewan and western Manitoba. Within the Basin there are ten of these survey segments associated with portions of six of the transects (Didiuk, 1999).

The North American Waterfowl Management Plan (NAWMP) delineated seven program delivery areas (landscapes) within Saskatchewan's parkland for targeting habitat programs because these areas provided the best potential for waterfowl production. Two of the program areas contain land within the Basin. This program was a source of information on wildlife and wildlife habitat in the Basin.

Ducks Unlimited has developed a GIS model that predicts and maps the breeding distribution of waterfowl in the prairie pothole region of Canada, including the Basin. Areas with higher breeding pair densities represent areas with better waterfowl habitat. This model incorporates data from the CWS/USFWS spring aerial surveys (pond and pair counts), Palmer Drought Index, Canada Land Inventory for waterfowl production capability, and DU satellite imagery (wetland habitat inventory). These maps were used to evaluate the long-term capability of the Basin for waterfowl breeding in relation to southern Saskatchewan.

2.2.3 Natural Fluctuations in Habitat

Wetlands and upland habitats can be affected by natural changes. Over several years of above or below average precipitation wetland basins and adjacent vegetation expand or decrease as the available water changes. Similarly, vegetation along streams and upland shrub and tree communities are influenced by available moisture.

A review of the literature provided a synopsis of the natural variation in conditions of habitat (Wapple 1999). This review provided information regarding changes in wetlands due to varying climatic conditions (e.g. drought), and gradual succession of plant communities in upland habitats over the long term.

Annual aerial surveys of wetlands in prairie Canada, including the Basin, provide an example of the large fluctuations in numbers of wetlands depending upon spring runoff conditions.

Photographs of wetlands under different wetland conditions (CWS unpub. data) provided an example of the natural changes in water level and vegetation which can occur at a given wetland over time.

2.2.4 Land Use Impacts on Habitat

Land use change in the Basin has also influenced the amount and character of wetlands and upland habitats. Human activities, including drainage and various agricultural practices, have reduced and continue to reduce the amount of wetland and upland habitats, and degrade habitats which remain. Available information was analyzed to describe some of these changes.

2.2.4.1 Agricultural Land Use Statistics

Data were acquired from the Statistics Canada census which is conducted every five years. The data from 1956 to 1996 census of farms were collated by rural municipality. Information selected was number of farms, number of acres in annual cropland, summer fallow, tame hay, seeded pasture, other improved and total unimproved acres. This information was interpreted to illustrate the change in land use in the Basin over the 40 year period.

2.2.4.2 Aerial Photo Studies

(1) Yorkton Area

Ducks Unlimited conducted a study in 1995 to document wetland loss that had occurred in the Yorkton region since 1949. The study area was a 100 by 100 kilometre square with the south west corner of the block located 19 km south and 38 km west of Yorkton. Aerial photographs, taken in 1949, of twenty randomly selected sections of land, were examined to estimate the baseline wetland acreage. Recent aerial photographs for the same sections of land were used to compare wetland conditions. This information was used to determine if any drainage activities had occurred and to estimate wetland losses. Recent satellite imagery was also used to check the wetland acreage calculations. This analysis was used to assess drainage activities in the Yorkton region and to compare the wetland habitat loss with the estimate of 40 percent often cited for the Prairies.

(2) Langenburg Area

An aerial photo study was done by Sask Water to prepare a summary of land use for the proposed Langenburg East Flood Control Project area in 1994. Aerial photos taken in 1957 and 1989 were used to classify land use in this area of 7,430 hectares to document land use change. Land use was classified as slough, bush, uncultivated, cultivated and miscellaneous.

(3) Township Study

An aerial photo study was done by Ducks Unlimited in 1998 to examine the extent of wetland areas affected by drainage works. The study areas comprised even-numbered sections in townships 23, 24, 25, 26, range 32, west of the principal meridian, and township 33, ranges 5, 6, 7 and 8, west of the second meridian. Aerial photos of 1980 and 1998 were compared with 1949 and 1950 photos. Total wetland areas in 1949/50 for each section were determined to produce the wetland area baseline values. Discernable drainage works as of 1980 and 1998 were plotted and transposed to the 1949/50 baseline photos. The total wetland areas affected by drainage in 1980 and 1998 were tabulated by section and summarized by township.

2.2.4.3 CWS Ground Surveys

The annual ground surveys conducted by the Canadian Wildlife Service along five transects in the Basin recorded agricultural impacts on wetland basins and their margins. These impacts were assessed by visual estimates of the area of basin, and the area of any margin which had not been cultivated. Agricultural impacts on wetland margins and basins assessed were:

1. cultivation: breaking of native vegetation of basins and margins and seeding and maintenance of crops; cultivation of basins was considered to be a transitory impact due to variable water conditions; cultivation of margins was considered to be a permanent impact since recovery of native vegetation was unlikely once cropping was established; the estimated margin width (0 - 10 m) represented the proportion of the margin width which was not cultivated (0% to 100%)

2. draining: evidence of drainage (e.g. ditching) which affected capability of the basin to retain surface water; in many cases shallow fall ditching of more temporary wetlands in cropland was not detectable as was sub-surface drainage; drainage could be variable in its effect

3.	clearing:	evidence of clearing of woody vegetation of basins or margins, in the form of piles of cleared material; although woody vegetation can recover, it most cases it was considered to be a permanent impact for both basins and margins once cultivation ensued
4.	filling:	placement of materials within the basin or along the margin; most often stone piles, occasionally refuse, and temporarily from the clearing of woody vegetation and prior to its burning
5.	haying:	evidence of haying of basin or margin (mowing, swaths or bale) in previous year; transitory impact upon basins and wetlands
6.	grazing:	evidence of use by livestock (presence of livestock, tracks, grazed vegetation, feces); transitory impact upon basins and wetlands
7.	burning:	evidence of burning in fall (weathered ashes) or current spring (less weathered ashes); transitory impact upon basins and margins
8.	farmyard:	portion of basin or margin within active farmyard; habitat may be intact but disturbance may affect use by breeding waterfowl and other wildlife; considered to be a permanent impact
9.	right-of-way:	portion of wetland adjacent to right-of-way of road; considered to be a permanent impact

2.2.5 Impacts of Habitat Loss and Change on Wildlife

Evaluation of the impacts of reduction and change in wetland and upland habitat on non-waterfowl species was based on a review of the available literature and the experience of wildlife managers. The literature review described rare, endangered and threatened plant and animal species that might be expected to live in the Basin. Feature species were identified that may not be presently at risk, but are of concern and are sometimes monitored due to their specific habitat association.

Potential effects of various land use activities, as they affect wetland and upland habitat, were described by a review and consensus by regional and provincial wildlife agency staff.

2.2.6 Social and Economic Considerations Associated with Wetlands and Upland Habitats

Wetlands and uplands are often associated with social and economic costs and benefits. These can be perceived at different ends of the spectrum. What may be considered a benefit to one segment of society may be an economic cost or liability to another. The description of these associated costs and benefits was based on discussions with landowners, agricultural producers and resource managers (agricultural, water, wildlife) as well as a review of literature.

To address land tenure concerns information was compiled on wetland and wildlife habitat lands held under some type of an agreement (title, lease, management or easement) by governments or conservation agencies. Maps were prepared to depict the results of this compilation.

Information on waterfowl depredation damage and compensation was compiled. Permits were examined to consider the economic benefits of hunting and trapping.

2.2.7 Strategies to Resolve Conflicts Between Land Use and Environmental Protection

The Wetlands Committee members considered the concerns and visions of local watershed committee members and landowners within the Basin, and those of various other stakeholders (including federal, provincial, municipal governments and environmental organizations) on a continual basis during the compilation, analyses and presentation of information regarding wildlife and their habitats.

The many types of information collected, analysed and prepared for this report provide several tools (e.g. habitat value maps) for use in local watershed planning. The Wetlands Committee members evaluated various approaches to co-operative watershed management, particularly on a sub-basin scale, to facilitate solutions to conflicts between current and proposed land uses, and environmental protection.

3 Results

This chapter presents the results of the Wetlands Committee's review and analysis of available information on the wetlands and uplands habitats and wildlife species in the Upper Assiniboine River Basin (UARB). Types of wetlands and upland habitats found in the Basin are described. Results of annual aerial surveys of waterfowl and ground surveys of wetland habitats are presented. Information from the literature review of animal species known or expected to live in the Basin is summarized. Changes in land use as illustrated by aerial photo interpretation are summarized to illustrate the effects of human activities on wildlife habitat. Impacts of habitat loss and change on wildlife are discussed. Social and economic considerations associated with wetland and upland habitat are presented.

3.1 Definition of Wetlands and Uplands

A commonly used definition of a wetland is a low-lying area of land which is covered by water often enough to support aquatic plants and animals for part of their life cycle. The area adjacent to the wetlands is described as uplands. The margins of a wetland may shift as the amount of water changes. The plants and animals associated with these margins depend on the characteristics of the wetland. Wetlands may be commonly called a marsh, slough, or pond.

An upland refers to the area of land around water bodies, in other words, land that is at a higher elevation than the bottom of the water body. An upland area can be classified by cover type as wooded cover, shrub cover, native grasslands (including native pastures), tame forage crops, and cereal cropland.

3.2 Types, Abundance and Distribution of Wetland and Upland Habitat

3.2.1 Types of Habitat

3.2.1.1 Wetlands

A wetland can be classified by the permanency of the water and the vegetation that it supports. The shape and size of the depressions and the amount of precipitation influence the amount of water a wetland retains.

Wetlands can be characterized as basins, riparian wetlands, or lakes. These types of wetlands are described below. More detail is provided in Wapple (1999) (see Appendix I). Illustrations of these wetland types and their distinguishing characteristics are shown in Figure 3.1.

(1) Basin Wetlands

There are five different types of basin wetlands that differ widely in water depth and permanence: temporary, seasonal, semi-permanent, permanent, and artificial. Each basin wetland type has a unique moisture regime in terms of how much surface water the basin holds and the length of time it remains. These factors determine the types of wetland vegetation and which wildlife species they will support, and habitat limitations due to environmental conditions such as short-term lowering of water levels due to drought. The heterogeneity of wetland habitats within these basins results in use by a wide variety of wildlife species (Wapple, 1999).

Wetland vegetation types occur in zones that correspond to different types of basin wetlands. Temporary basins support plant species characteristic of wet meadow vegetation such as grasses and sedges. Plant species representative of this vegetation type may also be present in the peripheral zones within seasonal, semi-permanent, and permanent basins. In addition to the wet meadow vegetation types found on their perimeters, seasonal basins support plant species characteristic of shallow marsh vegetation such as water-tolerant herbs and more robust grasses and sedges. The central areas of semi-permanent basins feature emergent deep marsh vegetation such as coarse emergents and submergent species, while shallow marsh and wet meadow vegetation types are found in characteristic zones towards the outer edges. The open water marsh zone in the central region of permanent wetlands will support submersed or floating vegetation, while shallower areas may support coarse emergents characteristic of deep marsh vegetation within semi-permanent basins. Similarly, shallow marsh and wet meadow vegetation types occur around the periphery.

(a) Temporary Wetlands

The prairie landscape is characterized by innumerable small shallow depressions carved out by the advance and retreat of glaciers. These fill with water from melting snow in early spring but due to their shallow nature (generally, maximum depth < 10 cm), dry rapidly due to drawdown soon after the thawing of the bottom ice seal. These depressions may also hold water temporarily following heavy rains later in the year, or may be present on the margins of more permanent wetlands. Most are dry by the end of May, and are often cultivated. If left undisturbed, they develop into wet meadows with pioneering early-successional plant species such as wild barley and sow-thistle. Later stages are dominated by these species, along with fowl blue grass, northern reed grass, baltic rush, and woolly sedge.

Temporary basins warm rapidly in early spring, resulting in the early development of invertebrate populations (Swanson *et al.* 1974). This provides crucial nourishment for early migrating ducks as well as arctic-nesting geese and shorebirds that frequently forage in these flooded fields en route to their breeding grounds during this time. These wetlands are important since they are the first wetland habitat in the prairie landscape where complex food webs are initiated following snow melt.

(b) Seasonal Basins

These wetlands have maximum water depths of up to one metre, usually become dry by late July, and are only cultivated during cycles of prolonged drought. Plant species occurring in these wetlands have adapted to the temporary nature of standing water (van der Valk and Davis 1978). Plant species characteristic of these basins include coarse grasses and sedges of intermediate height, such as tall manna grass, slough grass, awned sedge, and creeping spike-rush. Water-tolerant herbs such as common water-plantain, broad-fruited bur-reed and water-parsnip also thrive here, as well as floating plants such as various-leaved pondweed. Whitetop grass indicates more permanent water, while the presence of smartweed suggests drying of the wetland (Adams 1988).

Communities of plants and invertebrates, which vary in species composition depending on water regimes and salinity, produce an abundant variety and supply of food for marsh-dwelling organisms (Swanson and Duebbert 1989). The shallow waters of these wetlands are very important to dabbling duck species that feed on organisms at or near the water surface. Seasonal basins have abundant invertebrate production which is very important in determining waterfowl use. This protein-rich food supply is especially critical to female ducks during the breeding season for egg production and brood rearing. Van der Valk (1989) found that ducklings of all waterfowl species in the early developmental stages have diets dominated by invertebrate species, comprising as much as 100% of their diets in some species, and after several weeks of development on an animal diet, some species are known to shift to diets comprised of more vegetable matter. These wetlands are also heavily used by migrant waterfowl in the spring, but rarely in the fall since they are usually dry.

(c) Semi-permanent Basins

These wetlands usually have surface water persisting well into the fall and over the winter in most years. A mosaic of vegetation and open water is characteristic, with vegetation varying from uneven and patchy to completely overgrown. Floating and submergent vegetation in the open water zone may include pondweed and hornwort. Vegetation patches are typically dominated by coarse emergent vegetation such as cattail, great bulrush, river bulrush, prairie bulrush, and common reed grass.

Although ice cover of these wetlands disappears later than on temporary and seasonal wetlands and are therefore less important to foraging waterfowl early in the spring, nearly all of the prairie-nesting waterfowl use these basins for breeding activity. Weller and Spatcher (1965) found that use of these wetlands by breeding waterfowl was greatest when amounts of emergent cover and open water are approximately equal. These wetlands are also very important to prairie waterfowl for their summer molting, brood raising by females, and fall staging.

(d) Permanent Basins

These wetlands are permanently inundated and retain surface water throughout the year. They can be susceptible to drying out only following periods of extended drought. Sustained flooding results in an open water zone in the center of the wetland with submersed or floating types of vegetation. Shallow waters on the perimeters often support a distinctive band of coarse emergent vegetation such as cattail, great bulrush, and common reed grass. Water permanence results in decreased plant species diversity within these emergent stands when compared to other wetland types (van der Valk and Davis 1980) and peripheral vegetation characteristic of temporary and seasonal wetlands is often limited. This reduction in habitat diversity harbors fewer wildlife species. If a shoreline zone of coarse emergent vegetation is present, many of the marsh-nesting waterbirds also found in seasonal and semi-permanent wetlands may occur. Red-necked and horned grebes may occupy the central open water zone, nesting on exposed platforms of vegetation near the shore.

(e) Artificial Basins

These man-made wetlands are scattered throughout the Basin. Dugouts are typically small rectangular-shaped excavations that are used for watering of domestic livestock. Wetland vegetation is often sparse or absent. Dugouts are usually surrounded by piles of excavated material. Stock ponds are created by constructing berms or other barriers which impound water along drainage channels. These are also used for livestock watering and often support emergent vegetation that provides valuable habitat for waterfowl, songbirds, small mammals, and amphibians (Trottier 1992). Seasonal lowering of water levels due to seepage and evaporation in these wetlands can result in lush vegetation cover. Borrow pits and gravel pits are created by the excavation of materials required as foundation for road construction and maintenance. Following removal of this material, some of these excavations may fill with water that seeps upward from the water table, or from spring meltwater and precipitation.

These artificial wetlands usually have a reduced shallow water zone due to steep slopes into the basin. Consequently they often have limited vegetation diversity, perhaps supporting small stands of emergent cattails or bulrush and possibly some submergents.

(f) Riparian Wetlands

Riparian wetlands are found along watercourses such as creeks, streams and rivers and their adjacent banks. These habitats tend to have characteristics of both upland and aquatic ecosystems (Svejcar 1997), and they are very dynamic. Riparian wetlands fall into two categories: those that are permanent with flowing water throughout the year, and those that are intermittent with water flowing through them for only part of the year. Riparian wetlands are among the most ecologically diverse of all habitat types in the Basin and harbor a great diversity of flora and fauna. These areas are often very lushly vegetated, especially along some of the larger permanent flow watercourses in the northern part of the Basin such as the Assiniboine, Whitesand and Shell rivers. The numerous intermittent streams, many of which are tributaries of these rivers, only carry water during spring runoff and during periods of heavy rain later in the year. Although they often support less diverse plant assemblages than permanent streams, they are very important for wildlife species.

The convergence of different wet and dry habitats and dense vegetation associated with creeks and rivers offer food, cover and shelter for many wildlife species, resulting in a wide diversity of ecological niches for wildlife species to exploit. Since valley bottoms along creeks and rivers are often inundated due to runoff in early spring, and later exposed to drought conditions that often occur later in the summer, species of riparian vegetation have evolved an ability to tolerate a wide range of environmental conditions. The characteristics of these wetlands are dependent upon a number of factors: stream size, geology and hydrology of surrounding area, climatic variability, elevation, gradient, size of watershed, types of upland vegetation present, land management, and water use patterns (Svejcar 1997).

(g) Lakes

Lakes throughout the parkland region such as Silver Lake, Fishing Lake, and Good Spirit Lake, usually have firm sand or gravel bottoms and shorelines (Bird 1961). Shorelines of these lakes may be open and exposed, or vegetated with emergent or shoreline vegetation. Many lakes in the Basin are not deep or permanent enough to support fish populations. Low oxygen in late summer due to vegetation decay and low dissolved oxygen content at freeze-up in shallower lakes, make fish populations in these lakes vulnerable to winter kill.

Figure 3.1
Wetland Types

Canadian Wildlife Service

Temporary Basin

- **shallow depressions**
- **maximum water depth < 15 cm in early May**
- **usually dry by end of May**
- **fine-stemmed grasses and sedges**

Canadian Wildlife Service

Seasonal Basin

- **larger, more deep depressions**
- **maximum water depth 50 cm to 1 m in early May**
- **usually dry by late July**
- **grasses, sedges and variety of herbs**

Canadian Wildlife Service

Semi-permanent Basin

- large, irregularly shaped depressions
- maximum water depth > 1 m in early May
- usually contains surface water to freeze-up
- patches of coarse emergents (e.g. bulrush)

Canadian Wildlife Service

Permanent Basin

- very deep basins
- maximum water depth >>1 m in early May
- some may dry up after prolonged drought
- open water with submergent vegetation, usually rim of coarse emergents (e.g. cattail)

Canadian Wildlife Service

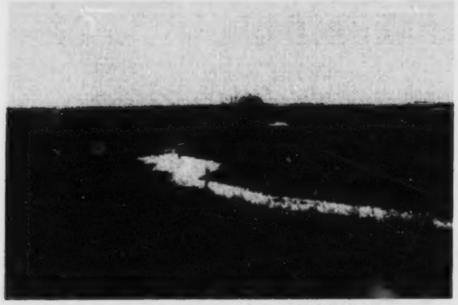
Dugout

- artificial wetland
- maximum water depth usually >> 1 m
- used for watering of livestock
- usually little shoreline vegetation

Alan Smith

Lake

- very deep, permanent basins
- maximum water depth >> 1 m
- may have various wetland types along shore
- trees and shrubs often along shore



Canadian Wildlife Service

Riparian habitat
along intermittent stream

- **streams usually dry by end of June**
- **pools of water may persist throughout summer**
- **variety of vegetation (trees, grass, some shrub)**
- **often used for livestock grazing**

Alan Smith

Riparian habitat
along permanent streams and rivers

- **streams maintain flow all year**
- **larger pools of water may occur along stream**
- **often wooded shorelines, shrubs common**
- **often used for livestock grazing**

(2) Proportion of Wetland Types

The proportion of types of wetlands in a region will depend on a number of factors such as land formation, slope, amount of precipitation, history of land use and land use practices. The annual CWS ground survey of five segments in the Basin illustrates that the number of each type of wetland varies among locations in the Basin (Didiuk 1999).

The ground survey classified each wetland along the five ground transects. Table 3.1 shows the number of wetland base types along the five ground transects within the Basin.

Figure 3.2 shows the proportion of wetland types in each of the five survey segments. Figure 3.3 shows the proportion of wetland types of all five segments combined. Temporary and seasonal wetlands accounted for over 85 percent of the wetlands along the five survey segments.

Table 3.1 - Number of Wetland Types in the Ground Survey Segments

Wetland Basetype	Yorkton	Buchanan	Nut Mountain	Wroxton	Penrith	Combined	Percentage
Temporary	71	144	93	79	121	508	33
Seasonal	132	364	138	69	107	810	53
Semi-permanent	38	46	0	5	18	107	7
Permanent	35	15	0	0	1	51	3
Stream Segment	3	8	2	2	7	22	1
Dugout	3	22	4	2	3	34	2
Borrow Pit	1	2	0	2	0	5	0.3
Total Wetlands	283	601	237	159	257	1537	99.3

3.2.1.2 Uplands

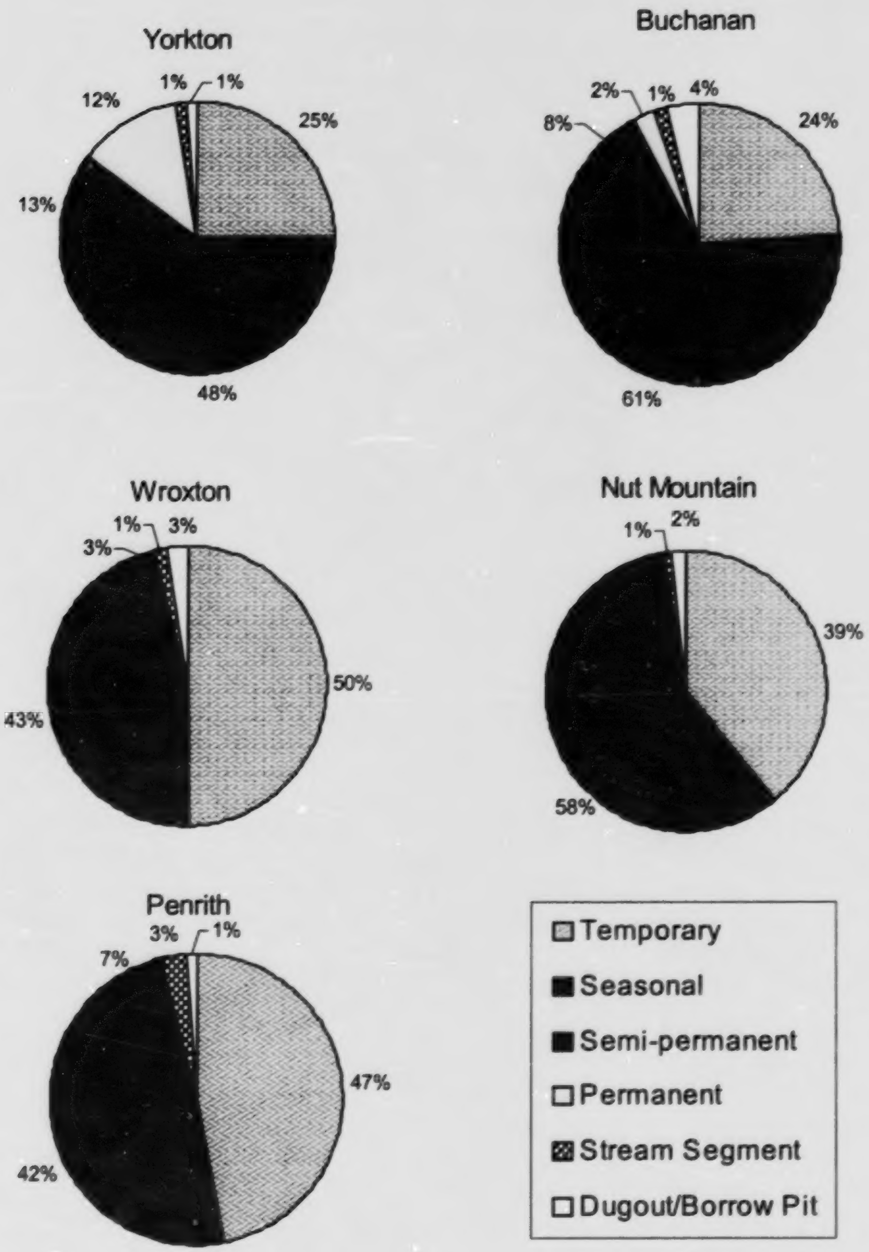
Uplands refers to the area of land around water bodies, in other words, land that is at a higher elevation than the water body. In the Basin, upland areas can be classified by cover type as wooded cover, shrub cover, native grasslands (including native pastures), tame forage crops, and cereal cropland. Illustrations of these upland habitats are shown in Figure 3.4.

(1) Wooded Uplands

Deciduous species such as trembling aspen, balsam poplar, Manitoba maple and white birch dominate woodlands of the Basin. One or more of a variety of willows often fringe these stands, especially in moist areas. Bur oak and green ash have a limited distribution in the Basin. Larger, more contiguous tree stands are typically found in the northern portion of the Basin. Many species of shrubs are found in the understory including green alder, choke cherry, Saskatoon, beaked hazelnut, wild gooseberry, and prickly rose. Herbaceous species include fireweed, wild sarsaparilla, palmate-leaved colts-foot, veiny meadow rue, smooth wild strawberry, and western Canada violet.

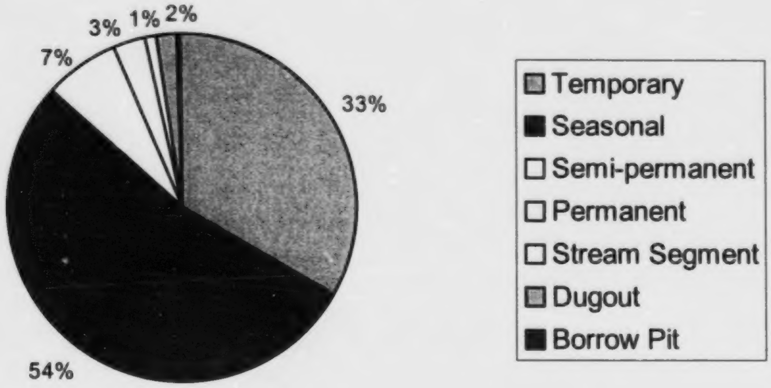
The Basin also contains mixed-wood forests. The Assiniboine and Shell rivers originate on the southern edge of the Mid-boreal Upland Ecoregion and flow south through portions of the Boreal Transition Ecoregion (Acton *et al.* 1998). Dominant tree species in these areas are the white spruce, trembling aspen, balsam poplar, and white birch. Black spruce, tamarack, balsam fir, and jack pine may also occur. Many herbs occur on the floors of these mixed-wood forests, including bishop's cap, hairy wild rye, vine-leaved coltsfoot, kidney-leaved violet, and common wintergreen. Mosses such as feather moss and knight's plume can be abundant.

Figure 3.2
Proportion of Wetland Types in Five Ground Survey Segments



Source: CWS Ground Survey Segments

Figure 3.3
Proportion of Wetland Types in Five Ground Survey Segments Combined



Source: CWS Ground Survey Segments

(2) Shrubs

Shrubs grow in low, moisture-retaining depressions within grasslands and along water margins, and form the understories and edges of larger stands of trees. Common species of shrubs include western snowberry, wolf-willow, buffaloberry, Saskatoon, chokecherry, hawthorn, and beaked hazelnut.

(3) Grassland

Blue grama, spear grass, little bluestem, June grass, and wheat grasses dominate grasslands of the Basin. Big bluestem, a grass species more characteristic of the tall grass prairie to the southeast, is often found on south facing prairie slopes along the Assiniboine River (Adam *et al.* 1982). This species likely reaches the northwest limit of its range in the Yorkton and Kamsack region, although the limits of its distribution are unknown (D. Nernberg, CWS, *pers. comm.*). Herbaceous plants of grasslands include pasture sage, prairie crocus, little club moss, early yellow locoweed, three-flowered avens, and creeping juniper.

Grasslands of the prairie pothole region have been altered more than any other ecosystem in North America (Bird 1961). Vast expanses of native prairie were once grazed by enormous herds of bison, elk, and pronghorn. Today most of the grassland in the Basin has been cultivated for agriculture and small remnant patches of native grassland are now grazed by domestic cattle. Simulating historic natural grazing patterns through proper grazing practices can maintain the viability of native grassland and minimize the negative effects of grazing on other wildlife species. This also benefits landowners by stabilizing financial return, lowering risks, and simplifying management (Trottier 1992). Overgrazing reduces the density and biomass of many plant and animal species, reduces overall biodiversity, interrupts ecological succession, impedes nitrogen cycling, changes habitat structures, and disturbs community organization (Fleischner 1994). McLaughlin and Mineau (1995) concluded grazing under any system has not been shown to enhance waterfowl production and is frequently detrimental to their populations. However, this topic is still heavily debated and more research is needed (M. Kornder, DU, *pers. comm.*).

(4) Cropland

A variety of crop species is grown from year to year depending on market prices and growing conditions. Croplands support very little wildlife due to the uniform species composition and structure of seeded plants. Some crops such as fall seeded winter wheat and dormant canola have potential to significantly improve nesting habitat while economically benefitting producers because they are not disturbed during spring nesting season. These crops are also economically beneficial to producers.

(5) Tame forage

Forage crops such as alfalfa, white and yellow clover, and smooth brome are grown for livestock feed.

(6) Proportion of Upland Types

The upland habitat adjacent to wetland basins is important breeding and foraging habitat for a variety of wildlife species. For example, many species use the wetland basins for foraging but select nest sites in both the wetland margin and adjacent upland. Table 3.2 shows the percentage of upland habitat type along each of the five ground survey transects by CWS (Didiuk 1999). About 72 percent of the upland was cropland and tame forage, 13 percent was wooded, 8 percent was native grassland and 7 percent was pasture.

Table 3.2 - Average Percent of Area of Habitat Type in Upland Area

Habitat Type	Yorkton	Buchanan	Penrith	Nut Mountain	Wroxton	Average
Crops	67	83	86	51	60	69
Hayland	6	1	1	5	1	3
Pasture	8	2	5	12	7	7
Native Grassland	7	4	3	14	15	8
Wooded	12	10	6	18	18	13

Source: CWS Ground Survey

Figure 3.4
Upland Types

Alan Smith

Aspen Woodland

- deciduous tree species such as trembling aspen, balsalm poplar, Manitoba maple and white birch
- many species of shrubs in the understory
- often fragmented in small stands
- often grazed by livestock

Alan Smith

Mixedwood Forest

- in more northern regions
- mosaic of softwood and hardwood forests, shrublands and wetlands
- habitat for boreal forest species
- some livestock grazing, some timber harvest

Garry Trottier

Shrubs

- in basins and along margins of wetlands
- in grasslands
- in and along edges of woodlands
- often used for livestock grazing

Canadian Wildlife Service

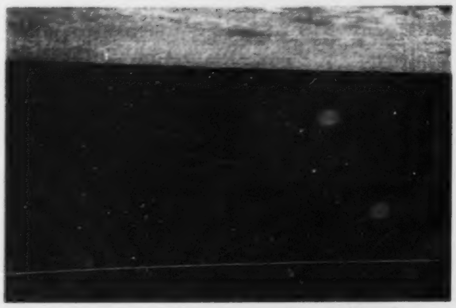
Grassland

- variety of native grass species
- most of the grassland in the basin has been cultivated
- remnants along wetland margins and areas of soil or relief less desirable for agriculture
- may be grazed

Canadian Wildlife Service

Crops

- a variety of crops
- support very little wildlife



Dean Nernberg

Tame Forage

- forage crops for livestock
- some wildlife use

3.2.2 Abundance of Habitat

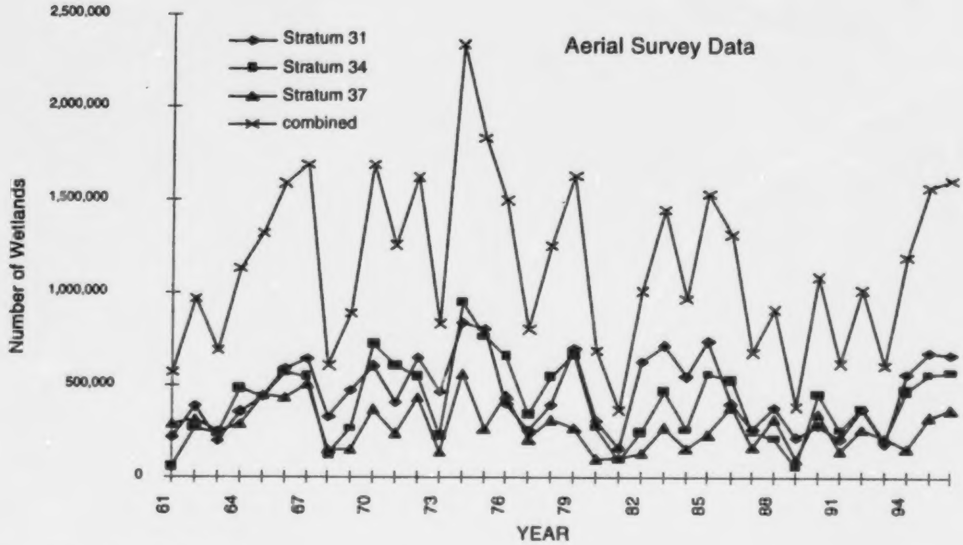
3.2.2.1 Wetlands

(1) Aerial surveys

Annual aerial surveys have been conducted by CWS and USFWS since 1961 in the Basin which is located within the eastern portions of aerial survey strata 31 and 34 in east central

Saskatchewan, and the western portion of stratum 37 in Manitoba (Figure 3.5). Counts of wetlands within these strata are highly variable among years, reflecting the high annual variation in water supply from spring run-off following snow melt. The years of 1987 to 1993 were relatively dry. Thus wetland numbers were low during those years and increased thereafter with increasing precipitation.

Figure 3.5
Number of Wetlands in Aerial Survey Strata 31, 34 and 27

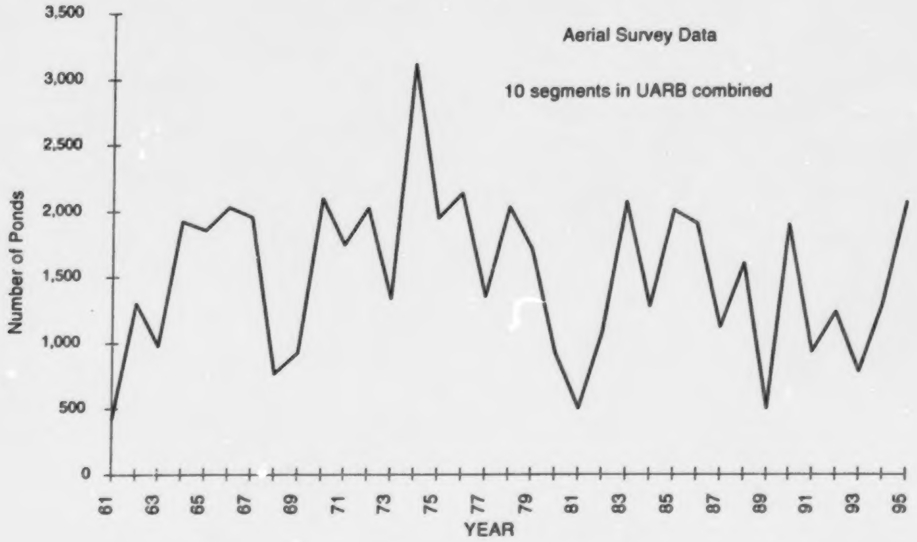


** Based on USFWS/CWS surveys.*

There was a similar variation in the number of wetlands for the 10 aerial survey segments within the Basin (Figure 3.6). The number of wetlands varied from 500 to over 3,000 between 1961 and 1995. Wetlands were relatively low in number in the Basin between 1987 and 1993, during a period of relatively low numbers throughout prairie Canada. The number of wetlands has been increasing since 1993.

Although the aerial surveys provide an index to abundance of wetlands, and illustrate the considerable variation in numbers of wetlands, the data do not indicate any dramatic decline in wetland numbers over the survey period. The data show that basins have been impacted by human activity. It must be noted these surveys record the number of wetland basins with surface water but do not include the temporary wetlands, or basins which remain but are dry.

Figure 3.6
Number of Wetlands Along Survey Segments in the UARB



** Based on USFWS/CWS Aerial Surveys.*

(2) Satellite Imagery

Wetlands were classified on a Landsat thematic mapper by Ducks Unlimited. Wetlands in the Basin were classified as open water, open turbid water, deep marsh, shallow marsh, wet/dry marsh, and mud flat. Table 3.3 summarizes the results of classification of the Basin wetlands.

Table 3.3 - Percentage of the Basin Area Occupied by Wetlands

Classification	Hectares	Acres	Basin Percentage*
Open Water	43,527	107,556	2.1
Open Turbid Water	148	366	<1
Deep Marsh	18,884	46,664	<1
Shallow Marsh	54,128	133,752	2.6
Wet/Dry Marsh	82,134	202,956	3.9
Mud Flat	50,245	124,158	2.4

** Represents the percentage of the Basin's total land area occupied by wetland. Based on satellite imagery.*

3.2.2.2 Uplands

(1) Satellite Imagery

Uplands were also classified by interpretation of the satellite imagery by the WGTPP. Land cover was classified as cropland, grass, bush, wetland, shrub and large lakes (Table 3.4).

Table 3.4 - Proportion of Land Cover in the UARB

Land Cover	Percentage
cropland	58
grass	17
bush	14
shrub	5
wetland	5
lakes	1
Total	100

** WGTPP satellite imagery.*

It should be noted that this WGTPP land classification used fall imagery when many wetlands are dry and reduced in size. Therefore the estimates of wetland areas are lower than those of the Ducks Unlimited classification (Table 3.3) which used spring imagery when the wetland area is greater. The WGTPP data best represent the more permanent water bodies in the Basin (lakes, semi-permanent and permanent wetlands). The Ducks Unlimited data include more ephemeral water bodies (temporary and seasonal wetlands).

3.2.3 Distribution of Habitat

3.2.3.1 Wetlands

(1) Aerial Surveys

Wetland basins with water are counted each year in southern prairie Canada by the CWS and USFWS. Figure 3.7 shows the variation in density of wetlands containing water under different moisture conditions. The years 1970-79 were a period of relatively good spring runoff and higher wetland water levels in southern prairie Canada. High densities of wetlands with water occurred in the Langenburg/Churchbridge areas and along the southwest fringe of the Basin west of Yorkton.

During the period 1980-89 conditions were significantly more dry in southern prairie Canada including the Basin. The density of wetlands in the Basin was considerably less during this time. Although reduced in number, greater densities of wetlands continued to occur in the Langenburg/Churchbridge area and along the western fringe of the Basin.

From 1990-95 good spring runoff greatly improved wetland conditions in the Basin and high densities of wetlands with water were recorded in a broad band along the southern and western portions of the Basin.

(2) Satellite Imagery

The classification by Ducks Unlimited of the satellite imagery of the Basin indicated that wetlands are abundant. However, some portions of the Basin have relatively fewer wetlands, particularly in the northwest portions of the Basin between Buchanan and Fishing Lake, the northern portion of the Basin north of Sturgis and in some areas immediately east of Lake of the Prairies.

This wetland classification using satellite imagery can be used at a finer scale to examine the distribution in a sub-basin or other smaller watershed. For example, the wetland distribution in the northern fringe of the Basin is shown in Figure 3.8. In contrast Figure 3.9 shows relatively fewer wetlands in the Whitesand River area.

3.2.3.2 Uplands

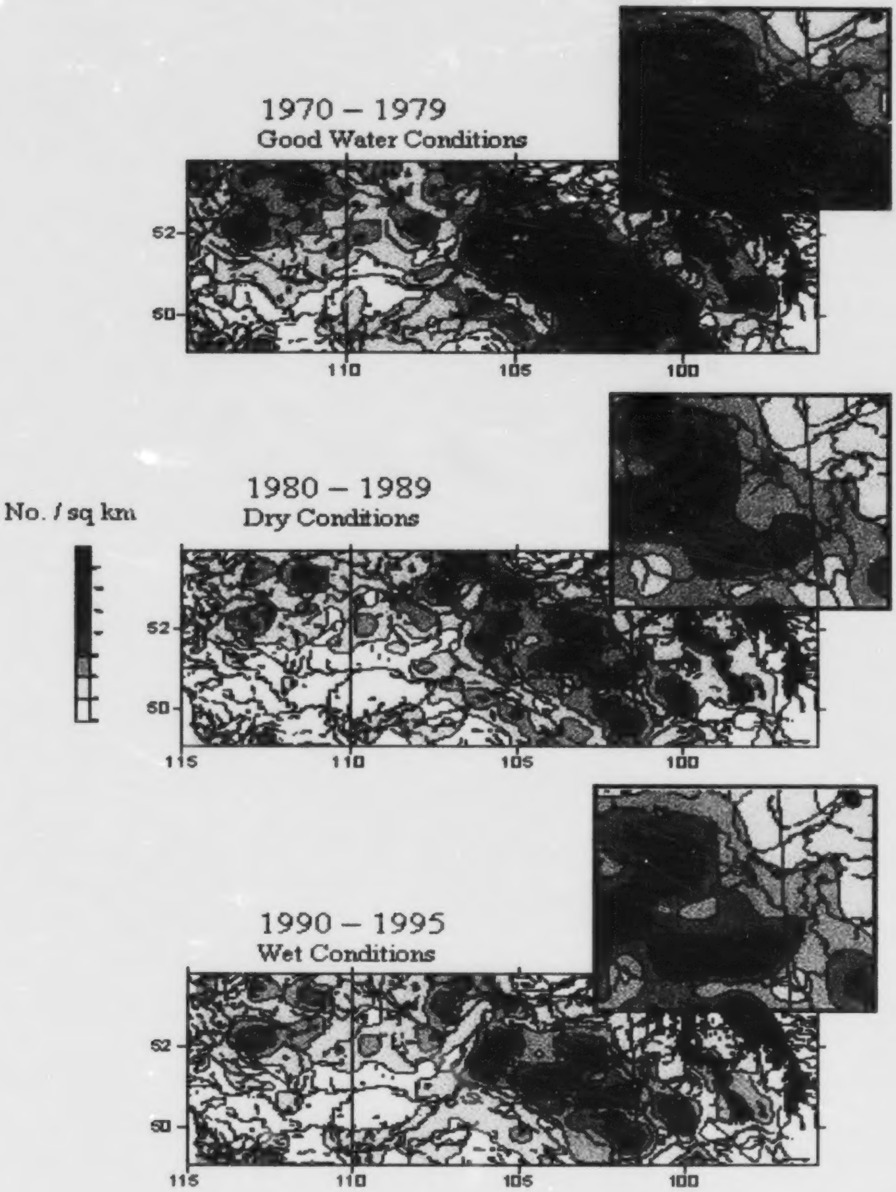
(1) Satellite Imagery

The WGTPP land classification using Landsat satellite imagery was used to map the distribution of upland habitat types throughout the Basin. Some portions of the Basin clearly have significant amounts of wooded cover. Examples are the Assiniboine River Valley, along the Lake of the Prairies, the southern fringe of the Duck Mountains in the northeastern portion of the Basin, the forest fringe in the northern portion of the Basin, north and west of Lady lake, and the region between Good Spirit Lake to Fishing Lake.

Grassland cover tends to be much more limited in the Basin, and larger expanses of this habitat type are mainly associated with community pastures.

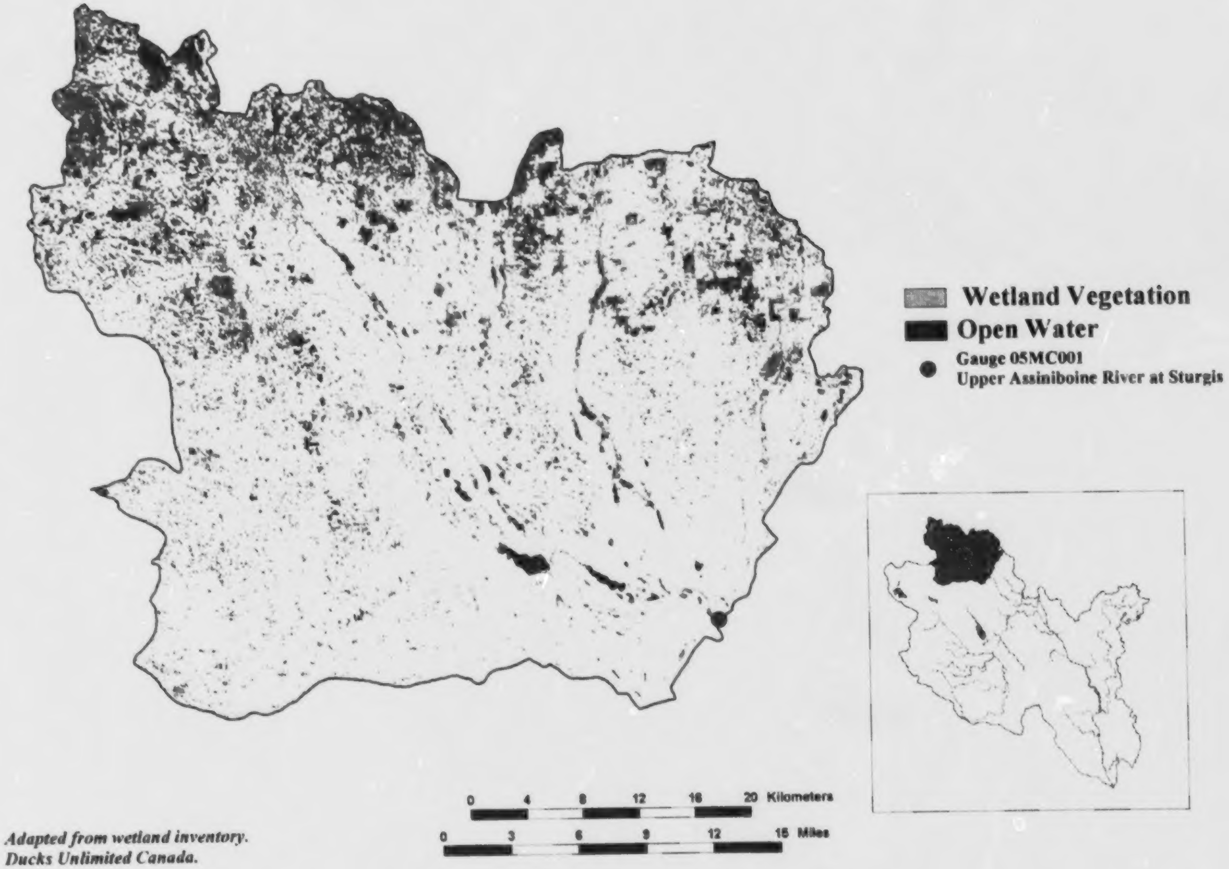
The different upland habitat types can also be examined for sub-basins or other smaller areas of the Basin. Figure 3.10 shows the distribution of upland habitat for the Upper Assiniboine River sub-basin. Figure 3.11 a) and Figure 3.11 b) show the distribution of upland habitat in the Upper Assiniboine River sub-basin at Sturgis and the Whitesand River sub-basin near Canora.

Figure 3.7
Wetland Density



** Based on USFWS/CWS Aerial Surveys.*

Figure 3.8
Wetland Distribution Upper Assiniboine River Sub-basin near Sturgis



Adapted from wetland inventory.
Ducks Unlimited Canada.

Wetland vegetation classes include deep marsh, shallow marsh, wet/dry marsh and mud flat. Open water classes include open water and open turbid water.

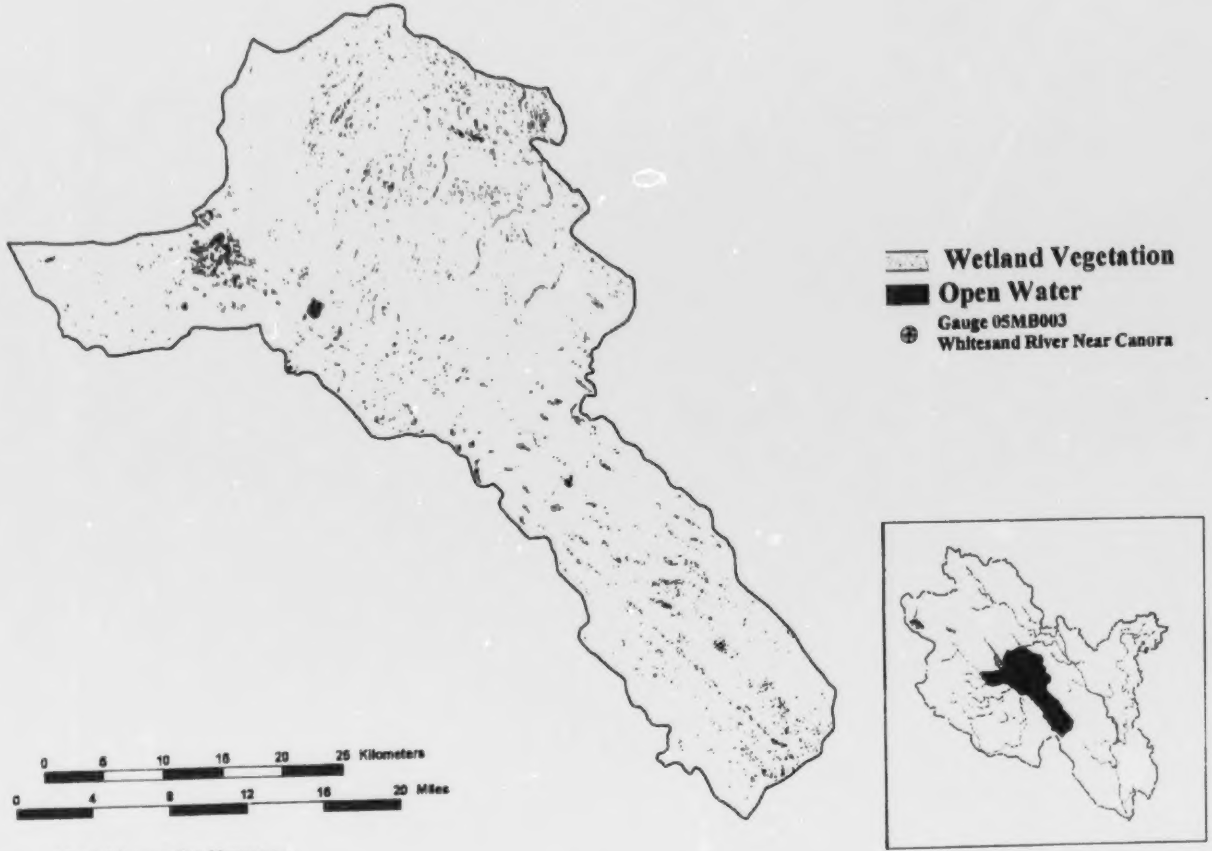


Figure 3.9
Wetland Distribution in the Whitesand River Sub-basin near Canora

Adapted from wetland inventory.
Ducks Unlimited Canada.

Wetland vegetation classes include deep marsh, shallow marsh, wet/dry marsh, and mud flat.
Open water classes include open water and open turbid water.

Figure 3.10
Upland Land Cover in the Upper Assiniboine River Sub-basin

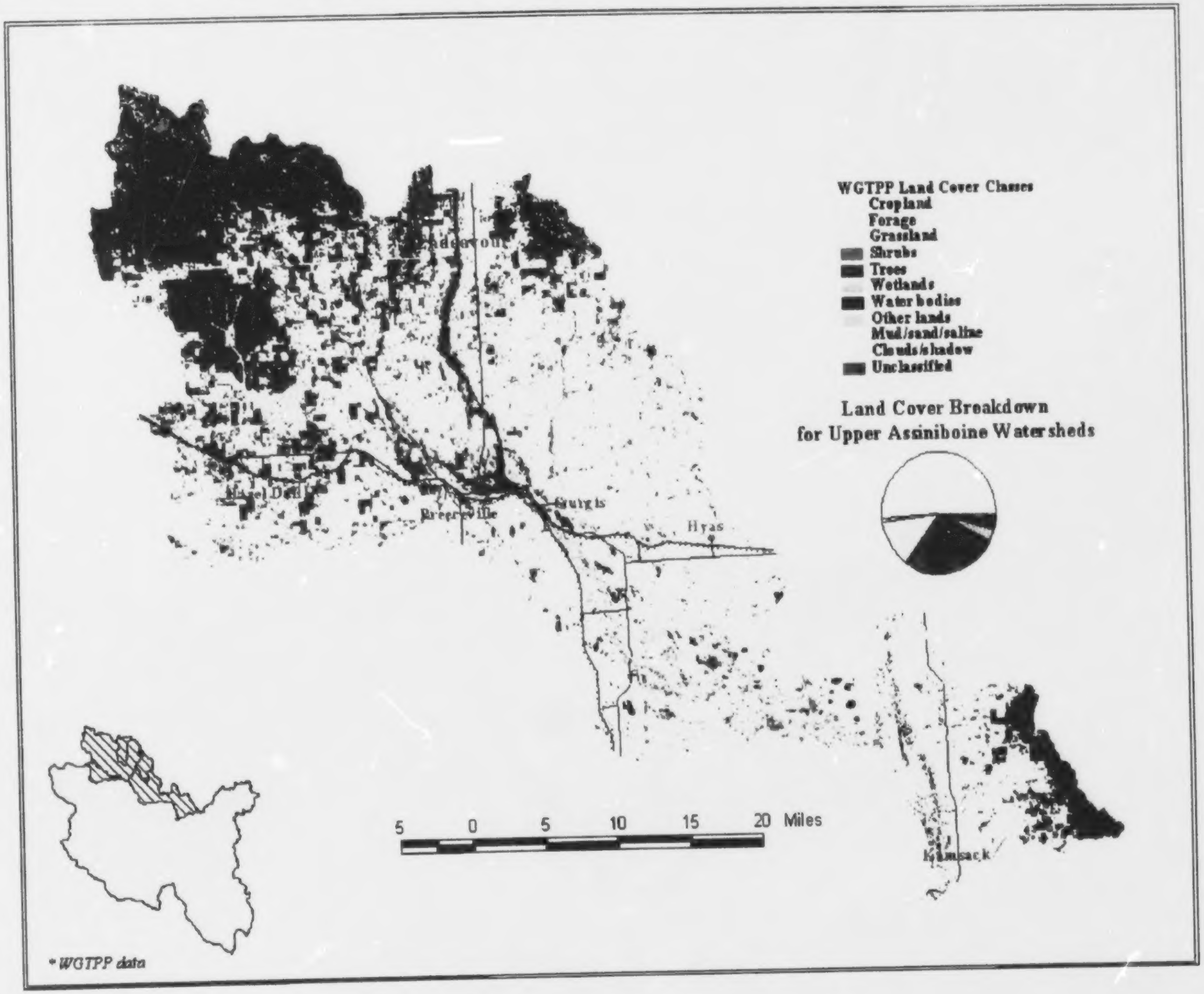
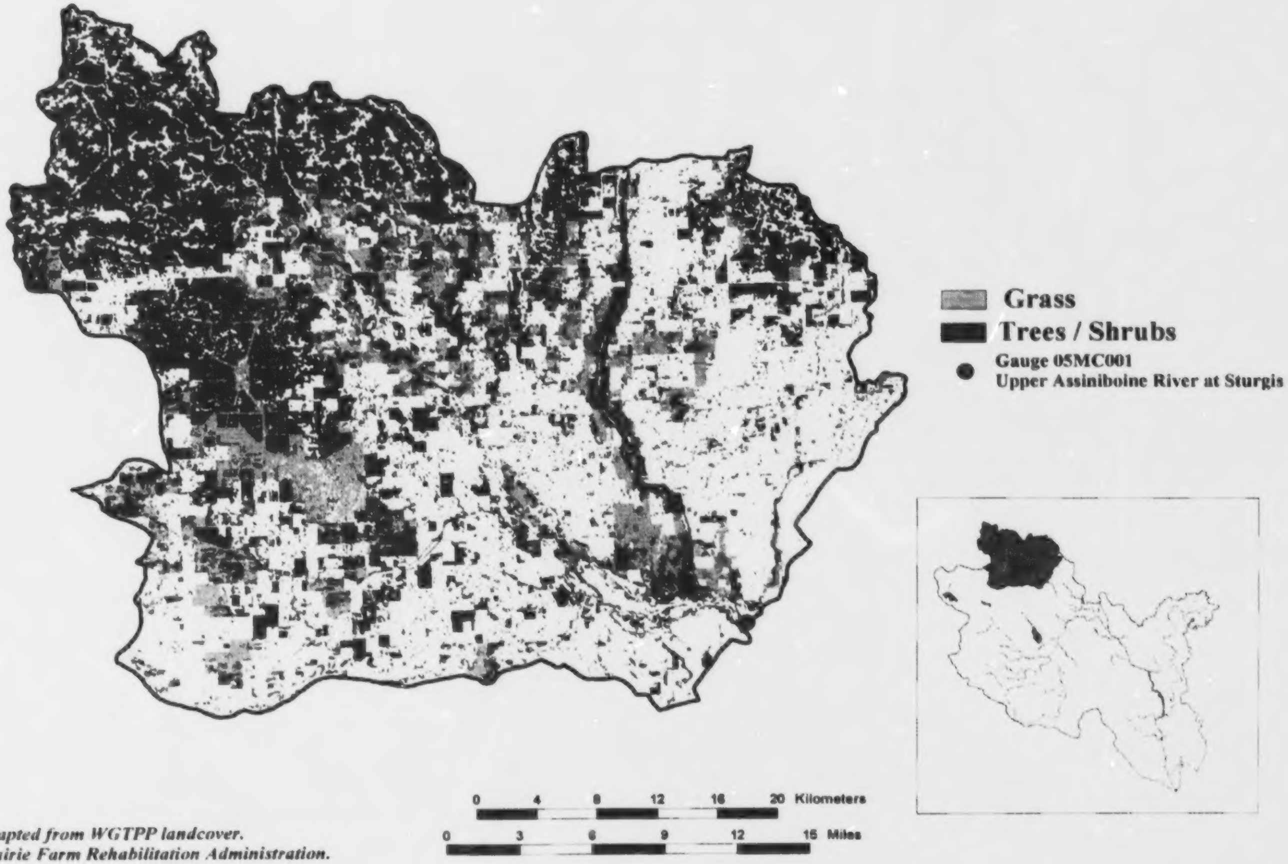
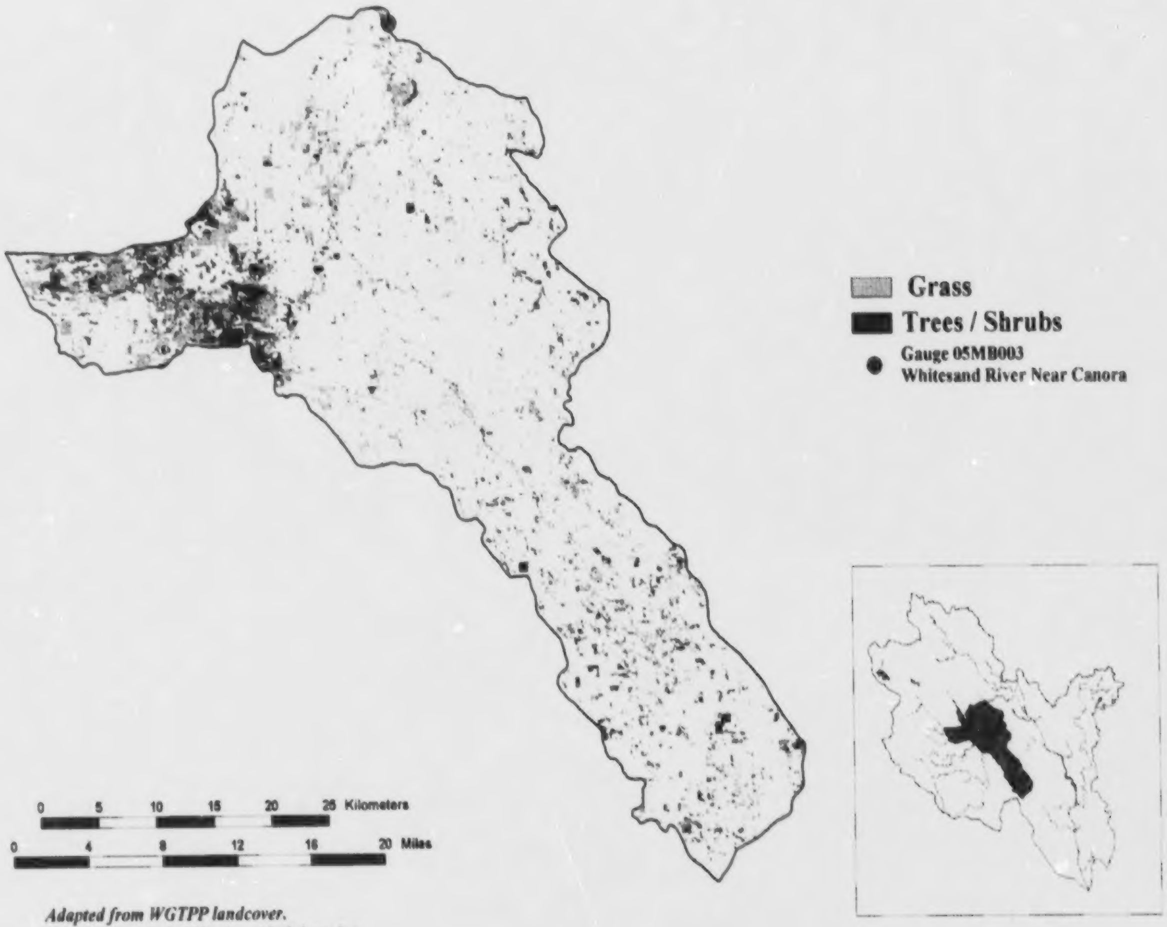


Figure 3.11 a)
Upland Land Cover in the Upper Assiniboine River Sub-basin near Sturgis



Adapted from WGTPP landcover.
Prairie Farm Rehabilitation Administration.

Figure 3.11 b)
Upland Land Cover in the Whitesand River Sub-basin near Canora



Adapted from WGTPP landcover.
Prairie Farm Rehabilitation Administration.

3.2.3.3 Habitat Quality

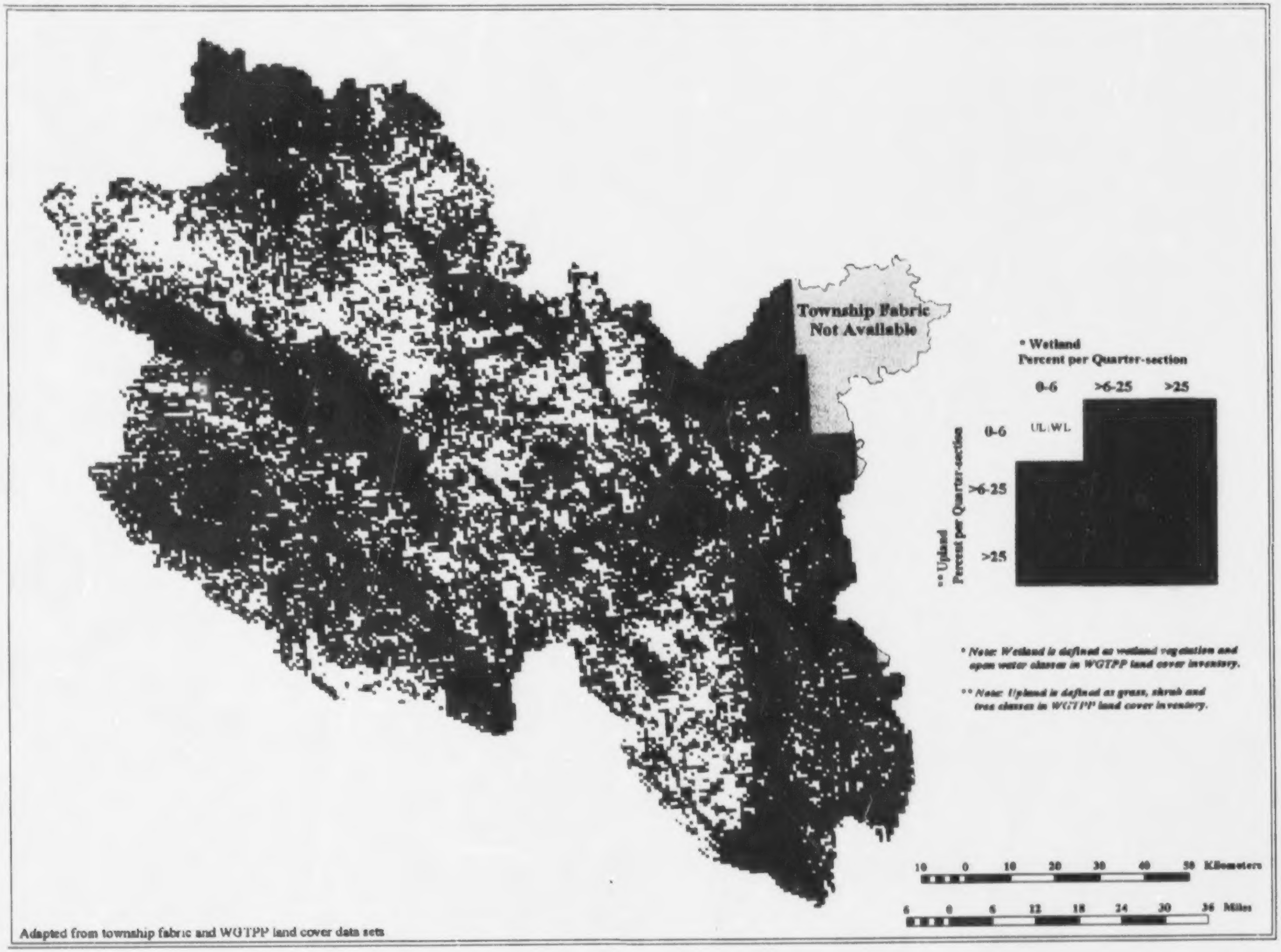
The habitat quality map, Figure 3.12, illustrates the area of upland native habitats and wetlands for each quarter section. The areas of the Basin that are light or medium blue indicate areas with significant amounts of wetlands but little native habitat. Those areas of the Basin that are light or medium green represent areas with significant amounts of vegetation, primarily woodland but with little wetland. Those areas of the Basin that are light or medium green represent areas with a significant amount of vegetation, primarily woodland but with little wetland. Some other areas of the Basin shown in orange or red have significant amounts of wetlands and uplands remaining. These latter areas are of particular importance when planning land use on a watershed basis. This habitat quality map can be an effective planning tool to examine the Basin as a whole as well as smaller areas such as shown in Figure 3.13. This map can be integrated with soil capability and other data bases to determine risk. These maps can allow assessment of risk to habitat with given land use scenarios at a scale sufficient for detailed sub-basin analyses or for the entire Basin. The habitat quality map would be useful to assist stakeholders involved in watershed planning to target areas for specific programs.

3.2.3.4 Landscape Units

The various maps developed depicting abundance and distribution of wetlands (Figure 3.8), uplands (Figure 3.10) and distribution of representative amounts of wetland and upland habitat (Figure 3.12) allow examination of the Basin to detect patterns of distribution of these habitats in the Basin. These map products, and other supplementary information (critical wildlife habitat maps, Canada land Inventory Land Capability maps for soils and waterfowl production, satellite imagery for land cover and wetland) were used to delineate 37 landscape units (Figure 3.14). In Table 3.5 each landscape is numbered and assigned a name based on prominent topographic features, names of localities or communities. Dominant landforms based on soils and topography from Terrestrial Wildlife Habitat Inventory maps (Hart and Stelfox 1981, Hart and Hunt 1982), land tenure and prominent species of wildlife are also listed in Table 3.5. Table 3.6 lists the percentage of major cover classes for each landscape unit.

Each landscape is assigned a separate low, medium or high value for wetland and for upland wildlife species and a combined value (based on the highest of the wetland or upland rating) as well as knowledge of committee members familiar with the area as well as critical wildlife habitat maps produced by the Terrestrial Wildlife Habitat Inventory (Hart and Stelfox 1981, Hart and Hunt 1982, Flory 1983). Some landscapes were retained as separate units because of differences in soils, risk of development and land tenure even though the color patterns of the matrix appeared to be similar. Risk of habitat change due to clearing and drainage was also assigned a low, medium or high rating based on the history of development in the area, soils and land tenure. This information may be useful for targeting habitat programs in areas where they would be of the greatest benefit.

Figure 3.12
Habitat Quality Matrix for the Upper Assiniboine River Basin

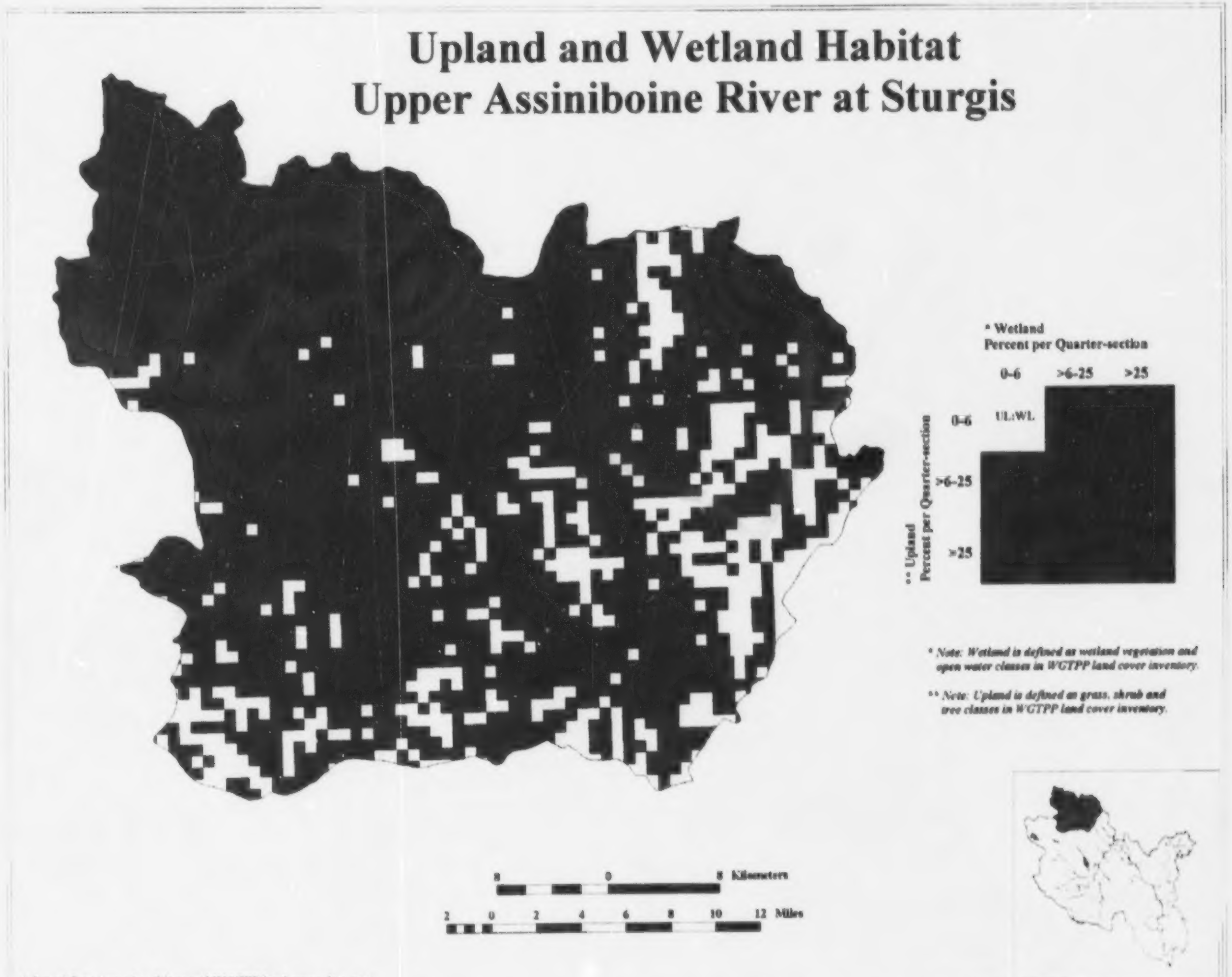

Township Fabric Not Available
* Wetland
Percent per Quarter-section
0-6
>6-25
>25
** Upland
Percent per Quarter-section
0-6
>6-25
>25
UL:WL
10 0 10 20 30 40 50 Kilometers
6 0 6 12 18 24 30 36 Miles

* *Note: Wetland is defined as wetland vegetation and open water classes in WGTPP land cover inventory.*

** *Note: Upland is defined as grass, shrub and tree classes in WGTPP land cover inventory.*

Adapted from township fabric and WGTPP land cover data sets

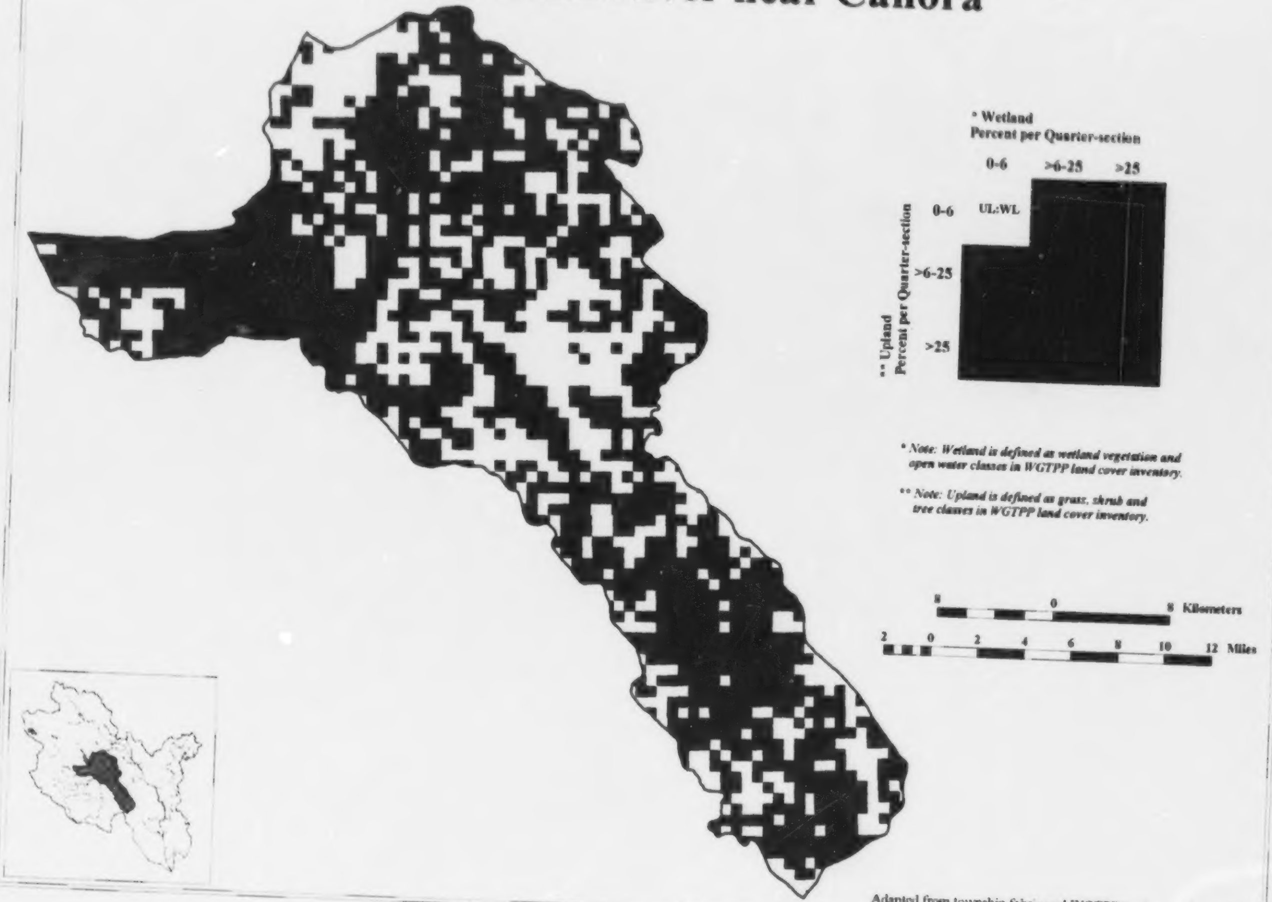
Figure 3.13
Habitat Quality Matrix for the Upper Assiniboine River Basin


Upland and Wetland Habitat
Upper Assiniboine River at Sturgis
* Wetland
Percent per Quarter-section
0-6
>6-25
>25
UL:WL
** Upland
Percent per Quarter-section
0-6
>6-25
>25
* Note: Wetland is defined as wetland vegetation and open water classes in WGTPP land cover inventory.
** Note: Upland is defined as grass, shrub and tree classes in WGTPP land cover inventory.
8
0
8 Kilometers
2
0
2
4
6
8
10
12 Miles

Adapted from township fabric and WGTPP land cover data sets

Figure 3.13 - continued
Habitat Quality Matrix for the Upper Assiniboine River Basin

Upland and Wetland Habitat
Whitesand River near Canora

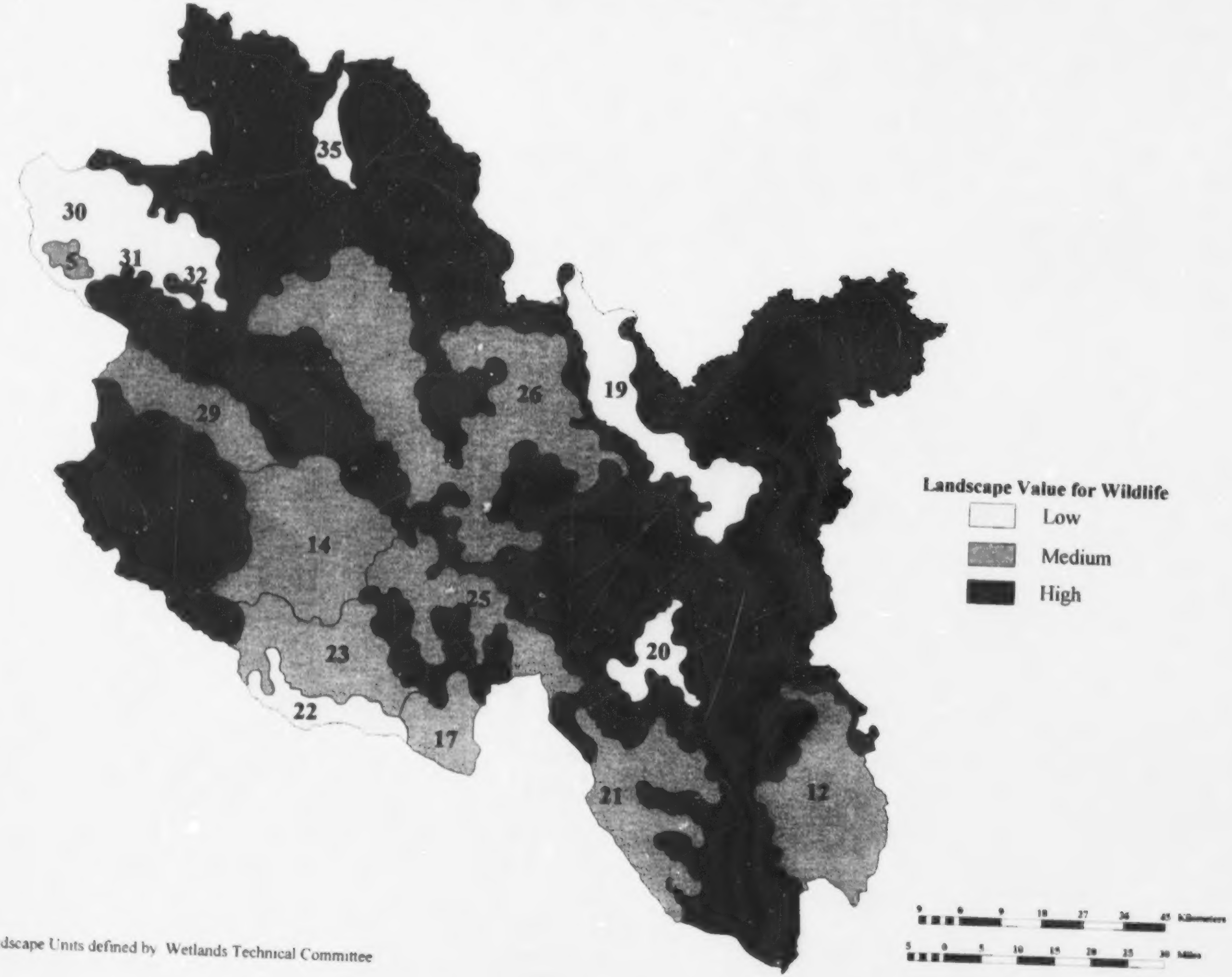


* *Note: Wetland is defined as wetland vegetation and open water classes in WGTPP land cover inventory.*

** *Note: Upland is defined as grass, shrub and tree classes in WGTPP land cover inventory.*

Adapted from township fabric and WGTPP land cover data sets.

Figure 3.14
Landscape Units of the Upper Assiniboine River Basin


35
30
5
31
32
29
26
19
14
25
23
22
17
20
21
12
Landscape Value for Wildlife
Low
Medium
High
9 0 9 18 27 36 45 Kilometers
5 0 5 10 15 20 25 30 Miles

Landscape Units defined by Wetlands Technical Committee

Landscapes 1 and 36 in the headwaters of the Assiniboine River (Table 3.6) illustrate the sharp differences in land cover which can occur in a short distance. Landscape 1 is approximately 5 percent crop land compared to Landscape 36 which is 75 percent crop land. The highest percentage of native cover occurs on landscapes 1 and 2 (95% and 91%, respectively) and the least occurs on landscapes 20 and 22 (both over 86% crop land).

Although the map may give the impression that habitat and land use change sharply in a short distance, the reality is that changes can be gradual and may not occur exactly on the ground where the line was drawn on the map.

This map indicates areas with significant upland and wetland habitat remaining. It is intended to be used as a planning tool to identify important wildlife habitats and assess the risk to habitat of given land use scenarios at a scale sufficient for overall Basin or sub-basin analysis. It is not detailed enough for planning on a smaller scale. Individual quarters or sections of land within the landscapes may have a much higher or lower value as wildlife habitat. The landscape units identify broad areas of similar habitat abundance and distribution on a gross scale. They give an overview of the Basin. Additional recent habitat and land use information and field assessment would be required for analysis of smaller areas.

Additional information on the land cover in the landscape units is provided in tables in Appendix III. These tables show the percentage of uplands and wetlands cover in each landscape unit, the number of quarter sections of upland and wetland habitat in each landscape unit by category (low, medium, high), and the number of hectares of each type of land cover in the landscape units.

Table 3.5 - Landscape Units

Area No.	Landscape/ Prominent Features	Landforms	Land Tenure	Prominent Wildlife Species	Habitat Value			Risk of Change		Other comments/ concerns
					Waterfowl	Wildlife	Combined	Clearing	Drainage	
1	Western headwaters of Assiniboine River	Moraine, Gray Soils	Porcupine Provincial Forest, Hazel Dell PFRA Pasture	green-winged teal, elk, white-tailed deer, moose, beaver, black bear, ruffed grouse	H	H	H	L	L	
2	Duck Mountain Provincial Park, Boggy Creek	Moraine, Meltwater Channel (Little Boggy Creek), Gray Soils	Provincial Park, Cote-San Clara PFRA Pasture	green-winged teal, white tailed deer, elk, moose, beaver, black bear, ruffed grouse	H	H	H	L	L	
3	Edge of Riding Mountain National Park, Upper Shell			elk, white tailed deer, black bear	M	H	H	M	L	
4	Dog Lake, Silver Lake, Ebel Lake	Washed Moraine	Foam Lake PFRA Pasture, Whitesand River	sharp-tailed grouse, white-tailed deer	H	H	H	L	L	
5	Fishing Lake	Alluvium, Moraine	Fishing Lake I.R.	white-tailed deer	M	M	M	L	L	recreation
6	West edge of Beaver Hills	Moraine, some Gray Soils (eastern portion)		white-tailed deer, ruffed grouse	H	H	H	H	M	wetlands complex
7	Beaver Hills	Moraine	PFRA and Provincial Pastures	white tailed deer, elk, waterfowl	H	H	H	H	M	
8	Good Spirit Lake, Horseshoe Lake, Patterson Lake	Fluvial, Fluvial Lacustrine and Aeolian	Provincial Park, Heritage Marsh, Provincial Pasture	white-tailed deer, ruffed grouse, moose	H	H	H	L	L	water quality because of watershed drainage, fishing
9	Junction of Whitesand River & Cussed and Yorkton Creeks	Lacustrine, Alluvium, Fluvial Lacustrine		white-tailed deer, ruffed grouse	H	H	H	H	H	
10	Lilian River & Assiniboine River east of Fulton Flats	Fluvial, Fluvial Lacustrine, Lacustrine, Meltwater Channel	The Key I.R., Lady Lake Provincial Community Pasture	white-tailed deer, ruffed grouse, beaver	H	H	H	H	H	sand dune complexes, local wildlife federation planting spruce
11	Shell/Assiniboine river corridor	Aeolian, Fluvial Lacustrine, Fluvial, Alluvium, Meltwater Channel, Moraine	Cote I.R., Spy Hill - Ellice PFRA & Togo & Calder Prov. Comm. Pastures	ruffed grouse, sharp-tail grouse, elk, white tailed deer	M	H	H	M	H	riparian habitat; Shell River/Duck Mountain Uplands, brush control in pastures
12	Russell	some wetland complexes	some Ducks Unlimited leases		M	M	M	H	H	

Table 3.5 - Landscape Units

Area No.	Landscape/ Prominent Features	Landforms	Land Tenure	Prominent Wildlife Species	Habitat Value			Risk of Change		Other comments/ concerns
					Waterfowl	Wildlife	Combined	Clearing	Drainage	
13	Yorkton South, Rokeby & Saltcoats	Alluvium, Lacustrine, Fluvial, Moraine	Crescent Co-op Pasture	upland colonial birds; great blue heron, black crowned night heron, sandhills, pelican roosting area, sharp-tailed grouse, white-tailed deer	H	H	H	L	L	
14	Willowbrook, Theodore, Springside	Moraine, Fluvial, Alluvium, Fluvial Lacustrine, Meltwater Channel		white-tailed deer, sharp-tailed grouse, ruffed grouse	M	M	M	H	H	includes Willow Brook & portions of Cussed Creek and the Whitesand River
15	Churchbridge, Wroxton plains	Moraine, Alluvium, Fluvial, pocket of Gray Soils east of Rhein		white tailed deer, sharp-tail grouse, ruffed grouse	H	H	H	VH	VH	ultra high value, SWCC habitat inventory
16	Langenburg and Marchwell South	Moraine, Fluvial		white tailed deer, ruffed grouse	H	H to L	H	H	H	wetlands with narrow fringes in a sea of crop
17	North of Bangor	Moraine, Fluvial Lacustrine, Lacustrine		white tailed deer, ruffed grouse	M	M	M	H	L	
18	Lake of the Prairies	Meltwater Channel, Eroded, riparian habitat	Crown Land adjacent to reservoir, Assinboine Slopes Ecological Reserve	elk, white tailed deer, black bear, ruffed grouse, songbirds, staging for snow geese	H	L	H	L	L	topography restraint for clearing, draining
19	Between Duck Mountain & Assiniboine River	Lacustrine, Meltwater Channel, Moraine, Fluvial, Fluvial Lacustrine	Keeseekoose I.R., Cote I.R.	white tailed deer, ruffed grouse	L	L	L	H	H	small area of wetlands at northern edge, predominantly agriculture, mix of Dark Gray, Gray and Black Soils
20	West of MacNutt	Moraine, Fluvial		white-tailed deer, ruffed grouse	L	L	L	H	H	predominantly agriculture, drained
21	Smith Creek & Deerhorn Creek	Moraine, Fluvial, Lacustrine		white tailed deer, sharp-tailed grouse, ruffed grouse	L	L to M	M	H	H	predominantly agriculture, drained
22	East and northwest of Melville	Fluvial, Moraine		white tailed deer, sharp-tailed grouse, ruffed grouse	L	L	L	H	H	predominantly agriculture, drained
23	McKim, Otthon, Plain View	Moraine, Fluvial, Alluvium		white tailed deer	M	H to M	M	H	H	

Table 3.5 - Landscape Units

Area No.	Landscape/ Prominent Features	Landforms	Land Tenure	Prominent Wildlife Species	Habitat Value			Risk of Change		Other comments/ concerns
					Waterfowl	Wildlife	Combined	Clearing	Drainage	
24	Homefield, Fenwood	Moraine		white tailed deer, ruffed grouse	H	H to M	H	H	H	
25	Yorkton, similar to 19, 20, 21	Lacustrine, Moraine, Alluvium		white tailed deer, ruffed grouse	M	M to L	M	H	H	large flat marshes, drained, remnant pockets of wetlands
26	Buchanan, Gorlitz, Ebenezer, Veregin	Lacustrine, Moraine, Fluvial Lacustrine, Alluvium		white tailed deer, ruffed grouse	M	M to L	M	H	H	predominantly agriculture, drained
27	Fulton Lake, Canora, Donwell, Mikado	Lacustrine, Moraine, flat relief		white tailed deer, ruffed grouse	H	H to L	H	H	H	should be a good area of high interest, ultra high
28	West of Good Spirit, Whitesand River	Washed Moraine, Fluvial, Fluvial Lacustrine	Foam Lake PFRA & Good Spirit Prov. Community Pasture	white tailed deer, ruffed grouse, sharp-tailed grouse	M	H	H	H	L	sandy, rocky soils
29	Tuffnell, Insinger	Moraine, Fluvial		white tailed deer, ruffed grouse	M	L	M	H	H	better soils, flat, farmed, intermediate between 26 and 21
30	North of Invermay, Kuroki & Kylemore	Moraine		white tailed deer, ruffed grouse	L	L	L	H	H	highly impacted, drained towards Fishing Lake, few remnants of habitat
31	Upper Whitesand complex - Margo, Usinneskaw & Whitesand Lakes	Moraine, Washed Moraine saline		white tailed deer, ruffed grouse	H	H	H	L	L	
32	Saline & Stonewall Lakes, see 31	Moraine			H	H	H	L	L	
33	Conjuring Creek, Rama, Hazel Dell	Moraine, Lacustrine, Fluvial Lacustrine		elk, white tailed deer, ruffed grouse	M	H	H	H	H	gray, dark gray and black soils
34	Southwest of Lintlaw	Moraine		white-tailed deer	H	M	H	H	H	
35	Between riparian corridors, west of Lilian River			white-tailed deer, ruffed grouse, moose	L	L	L	H	H	some remnant habitat
36	Eastern headwaters of Assiniboine River		Porcupine Provincial Forest	green-winged teal, white-tailed deer, moose, elk, beaver, black bear, ruffed grouse	H	H	H	L	L	
37	Edge of Riding Mountain National Park, Upper Shell			elk, white tailed deer, black bear	H	H	H	M	L	

Table 3.6 - Percentage of Land Cover in Landscape Units

Landscape	Crop	Forage	Grass	Shrubs	Trees	Wetlands	Water	Mud_Sand	Other
1	4.51	0.23	7.66	3.72	64.8	9.27	7.94	1.71	0.15
36	74.49	0.88	5.1	4.6	10	2.15	1.37	0.57	0.83
10	48.46	1.07	23.5	10.02	6.6	4.97	4.35	0.21	0.8
35	54.48	5.94	14.31	8.35	13.73	0.76	1.39	0.42	0.62
33	64.09	1.74	8.64	9.99	13.15	0.2	0.78	0.64	0.77
34	79.78	1.56	0.72	4.5	5.56	0	5.02	2.02	0.84
30	84.16	0.86	2.55	4.64	1.93	0.27	4.35	0.34	0.9
26	84.24	0.17	9.31	1.86	1.34	1.43	0.49	0.22	0.94
11	28.99	2.36	23.86	2.51	33.13	4.96	0.03	0.02	1.38
5	16.13	0	17.1	3.63	4.66	2.52	53.94	1.88	0.14
27	77.26	0.1	12.35	1.11	1.5	4.01	2.35	0.35	0.97
19	75.31	1.25	11.1	2.77	5.82	1.8	0.62	0.04	1.29
2	8.49	1	16.58	3.5	59.6	5.9	4.69	0.01	0.23
31	19.36	3.49	14.08	5.65	13.07	0	39.06	4.99	0.29
28	31.79	0.39	38.67	12.48	13.01	1.27	1.37	0.4	0.6
32	57.7	4.16	0	5.15	0.82	0	31.76	0	0.41
4	14.98	0.43	42.31	21.62	8.04	2.4	9.29	0.28	0.64
8	11.56	1.22	27.27	8.86	14.16	11.46	23.94	0.58	0.94
29	75.37	0.61	10.91	5.01	2.72	1.08	1.84	0.18	2.29
6	70.12	0.4	10.36	7.05	3.76	3.56	3.04	0.82	0.89
7	35.03	0.58	30.43	20.64	7.84	2.35	1.98	0.36	0.78
38	48.98	1.68	31.9	9.31	5.97	1.28	0.21	0.16	0.52
18	11.15	1.76	27.77	14.3	16.77	1.38	26.06	0.14	0.67
15	70.94	0	11.62	3.17	3.97	6.85	1.43	0.63	0.63
3	8.22	1.52	21.98	0	52.85	5.25	9.1	0	1.08
14	65.82	0.87	22.16	4.07	2.37	2.41	0.59	0.37	1.32
9	47.98	0.28	30.31	6.15	4.83	6.51	2.32	1.13	0.5

Table 3.6 continued - Percentage of Land Cover in Landscape Units

Landscape	Crop	Forage	Grass	Shrubs	Trees	Wetlands	Water	Mud_Sand	Other
25	78.06	0.02	11.15	1.38	1.89	1.67	0.88	0.2	3.99
24	74.27	0.06	5.64	3.04	8.53	2.11	2.73	2.43	1.2
20	86.24	0.63	6.76	1.46	1.37	2.41	0.16	0.56	0.41
13	42.44	0.04	34.14	2.63	1.92	7.3	7.55	1.81	0.53
23	72.18	0.8	17.13	5.08	3.32	0.79	0.57	0.04	0.09
37	26.73	4.7	23.6	0	33.59	3.17	6.42	0	1.79
22	86.27	0.59	4.11	3.39	0.22	1.01	1.09	0	3.32
12	66.84	0.01	18.87	0	4.56	2.75	1.64	0	2.96
17	64.6	0.57	12.71	7.22	6.03	1.64	0.34	0.03	0.04
21	83.94	1.53	3.83	4.49	3.13	1.93	0	0.11	0.76
16	83.77	1.07	4.36	3.59	2.66	3.92	0.26	0.09	0.28

3.3 Importance of Wetland and Upland Habitats for Wildlife

3.3.1 Wildlife Use of Habitats

3.3.1.1 Wetlands

Northern prairie wetlands play an important role in the life cycles of many terrestrial, aquatic and semi-aquatic wildlife species. Factors that determine the importance of wetlands as wildlife habitat include wetland size, structural diversity of vegetation, plant species diversity, salinity, land use in surrounding area, spatial distribution of wetlands, and water chemistry (Sather and Smith 1984). Wetland type has a large influence on food supplies for wildlife, and nutritional value and food availability have been shown to be important factors in determining food selection by waterfowl (Swanson and Duebbert 1989).

Wetland complexes that contain several different types of wetland vegetation will result in the availability of more ecological niches, which will benefit a broader diversity of wildlife species. Wetlands often contain more than one zone of characteristic wetland vegetation according to water permanence. These zones typically form rings of different vegetation proceeding from the wetland periphery to the central zone along an elevation and moisture gradient. Plant species diversity is highest in the peripheral wet meadow zone, and decreases with water permanence (van der Valk and Davis 1978).

3.3.1.2 Temporary Basins

When temporary basins dry in the spring, the meadows are no longer used by water-associated birds but provide breeding habitat for birds of prey, such as northern harrier and short-eared owl, and songbirds such as the bobolink, western meadowlark, savannah sparrow, and Le Conte's sparrow. Occasionally, willows may become established if there are many consecutive disturbance-free years which provide breeding habitat for the alder flycatcher, loggerhead shrike, yellow warbler, common yellowthroat, and song sparrow. Many species of dabbling ducks use these meadows and surrounding uplands for nesting.

These wetlands, and the meadows they develop into, are extensively used by a variety of mammal species. Vegetation zonation dictates habitat use by small mammals (Pendleton 1984). Six species can occur in wetland habitats within the Basin. Meadow voles and meadow jumping mice prefer habitat with higher levels of soil moisture and adequate vegetation for shelter. Thirteen-lined ground squirrels and deer mice also occur here, but favor drier areas. Sites of intermediate moisture were favored by both masked and short-tailed shrews. The Franklin's ground squirrel, which can be a significant predator on duck eggs (Cowardin *et al.* 1983), prefers more upland sites that border the edges of these and other wetlands.

The role of small mammals in wetland nutrient flow is poorly understood, but it has been suggested that they are likely not of great importance due to the low species diversity (six species), and low consumption rates of plant species documented in similar habitats in other geographic locations (Fritzel 1989). However the meadow vole has been reported to be the most numerous rodent species in this habitat, often accounting for more than 40 percent of individuals (Fritzel 1989). These rodents play a key role in the life cycles of their predators, especially the short-eared owl, northern harrier, long-tailed weasel, and least weasel. Populations more than 40 percent of individuals (Fritzel 1989). These rodents play a key role in the life cycles of their predators, especially the short-eared owl, northern harrier, long-tailed weasel, and least weasel. Populations of these four predators all depend heavily on cyclical populations of these rodents (Fritzel 1989; Wellicome and Haug 1995; Errington and Breckeridge 1936; Polderboer *et al.* 1941).

Striped skunks are among the most numerous and widespread species of predator in the prairie region and they utilize all types of habitats. Temporary wetlands are used extensively by skunks as nocturnal foraging grounds throughout the spring, summer and fall (Fritzel 1989). Duck and songbird nests located in peripheral wet meadows and surrounding uplands are especially vulnerable to foraging skunks (Verts 1967).

3.3.1.3 Seasonal Basins

Wet sedge meadows on the perimeters of seasonal basins are used by nesting yellow rails, Wilson's phalaropes, common snipes, sedge wrens, and Le Conte's sparrows. Stands of emergent bulrush and cattail provide nesting habitat for American bittern, sora, Virginia rail, marsh wren, Nelson's sharp-tailed sparrow, and red-winged blackbird. Weller and Spatcher (1965) demonstrated that the most important factor for birds nesting in basin wetlands is vegetation structure.

As the standing water begins to recede, the exposed mudflats are used for foraging by prairie shorebirds such as killdeer and American avocet, which nest along barren shorelines, and marbled godwit and willet, which nest in adjacent uplands. When evaporation of surface water from these shallow waters due to climatic factors and evapotranspiration of moisture from the tissues of wetland plant species exceeds the input of water from runoff and precipitation, these mudflats often develop into alkali flats. This process is the result of the concentration of salts built up in the soil from long term cyclic patterns of evaporation and flooding. These flats are very important foraging sites for the 23 species of shorebirds that migrate through the prairie pothole region as they travel to and from nesting areas in northern boreal forests or on the Arctic tundra (see Appendix 9 in Wapple, 1999). These shorebirds favor brackish waters that support large populations of protein-rich brine shrimp and other invertebrate species, which are an important energy source for meeting the physiological demands of shorebird migration. Arctic-nesting peregrine falcons also migrate through the area during this time and prey on this abundance of migratory shorebirds.

Small mammals inhabiting the margins of seasonal basins include meadow jumping mouse, deer mouse, and meadow vole. Predatory mammals such as red fox and long-tailed weasel, feed on these rodents as do birds of prey such as the northern harrier and the short-eared owl. Smaller mammalian terrestrial predators, such as masked shrew, pygmy shrew, and semi-aquatic amphibian predators such as northern leopard frog and boreal chorus frog, also occur along the margins of these wetlands where insects are abundant. Northern leopard frogs use temporary and seasonal wetlands for courtship activities (Kantrud *et al.* 1989). Tiger salamanders often lay their eggs in seasonal wetlands and are somewhat adapted to saline conditions. After hatching, salamander larvae are completely aquatic, but leave these wetlands once they reach adulthood (Cook 1966). Seasonal wetlands are important for tadpoles of frogs and toads and salamander larvae that grow rapidly and reach adulthood in a short period of time (Galatowitsch and van der Valk 1994). Garter snakes also frequent these wetlands, feeding on plentiful prey items that include invertebrates, toads, frogs, salamanders, and small mammals found along the vegetated margins of these wetlands.

3.3.1.4 Semi-permanent Basins

During the breeding season, dabbling ducks utilize the shallow waters of these wetlands for feeding and reproduction, and they nest in adjacent upland areas. The deeper open water zone is used by foraging pied-billed grebes, American coots, black terns, and numerous species of diving ducks where they nest on platforms of vegetation concealed in stands of emergent vegetation. Other bird species that build well-concealed nests in these emergent stands include American bittern, Virginia rail, marsh wren, red-winged blackbird, and yellow-headed blackbird. In extensive emergent stands where colonies of both red-winged and yellow-headed blackbirds co-exist, red-wings usually nest closer to the shoreline on the perimeter of the central zone which is occupied by colonies of yellow-heads. Horned and eared grebes also forage in the open water zone, but nest closer to shore on exposed platform nests attached to submersed vegetation. Formerly breeding in wetlands throughout the Basin (Houston 1949), a small population of sandhill cranes still breeds in the large wetland complexes south of Yorkton (Burke 1996). These wetlands are also used by migrating whooping cranes for roosting sites (Lewis 1995).

Woody vegetation, mainly willows, often develops around the edges of these wetlands and provides nesting and foraging habitat for the alder flycatcher, yellow warbler, common yellowthroat, and song sparrow. Black-crowned night herons also breed in these wetlands, using thick stands of emergent cover or one of a variety of tree species (Davis 1993). A night heron colony at Upper Rousay Lake alternated between nesting sites in emergent vegetation and dense willows (Houston 1949).

Well-treed semi-permanent wetlands are important to white-tailed deer for shelter in fall and winter, especially if willows are the dominant tree species (Brewster and Longmuir 1994). Dense stands of cattails in these wetlands provide deer with excellent thermal cover during severely cold or windy weather during the winter months. Treed wetlands are also important for fawning and fawn-rearing in the spring and summer (Harmoning 1976; Brewster and Longmuir 1994). Woody vegetation growing on the margins of wetlands also offers browse for foraging deer.

Raccoons and striped skunks utilize all wetland types extensively, mainly for nocturnal foraging. Various wetland organisms comprise their omnivorous diets, including rodents, snakes, frogs, salamanders, crustaceans, aquatic insects, and the eggs and young of ground-nesting birds. While skunks are restricted to the dry margins of wetlands, the dominance of wetland organisms in raccoon diets (Fritzel 1989) suggests that their foraging habits are not restricted to the wetland margins. Dense emergent stands of wetland vegetation are often used as denning sites by skunks during the winter months (Fritzel 1989). Raccoons are known to use abandoned muskrat lodges for denning (Dorney 1954).

Mink are more closely associated with wetland habitats than any other mammalian carnivore in this region (Fritzel 1989). Food studies indicate that the proportion of animals in the mink diet vary seasonally (Waller 1962). The abundance of aquatic birds occupying wetlands during the spring, summer, and fall likely results in these species comprising the majority of prey items taken during these months. Mink are likely a major predator of muskrats due to their ability to overtake them in the water, which gives them an advantage over terrestrial predators such as coyote and red fox. Muskrats and small mammals are probably the main items taken in winter because all water-associated birds in the Basin migrate to warmer climates in winter. Mink are also more likely to explore other habitat types during the winter months due to the lack of food items in wetlands during this season.

Muskrats have the largest impact upon wetlands of all wildlife species inhabiting semi-permanent basins in the prairie pothole region. They are the primary grazing species in these wetlands and their activities have a large influence on the structure of the emergent vegetation, which affects other biotic communities within these wetlands (Fritzel 1989). The favored food of the muskrat throughout the northern prairies are cattails and bulrushes (Fritzel 1989). The tender shoots are eaten and the tougher leaves and stems are used in the construction of their dens or left to form floating mats of decaying vegetation that are used as feeding platforms. Therefore, muskrats are regarded as keystone species of these wetland communities because their activities result in alterations to their habitats that have dynamic implications, both positive and negative, for other species.

Although found in all wetland types, muskrats are abundant in semi-permanent wetlands. Muskrats must abandon semi-permanent basins during drought years if these wetlands dry out over the summer, and seek out deeper bodies of water that will have open water below the ice in winter. Muskrats build large, mound-shaped dens out of emergent vegetation. A den contains a large chamber for feeding and resting, as well as one or two plunge holes that are kept ice-free throughout the winter by muskrat activity, allowing access to underwater vegetation for winter sustenance. The portions of these dens that protrude above the water surface serve as substrates for some species of wetland vegetation (Kangas and Hannan 1985). They are also used for nesting sites by wetland bird species including Forster's and black terns (Welder and Spatcher 1965), and Canada geese (Hjertaas 1975). Mammalian species that use abandoned muskrat dens for shelter include meadow vole, mink (Errington *et al.* 1963), and raccoon (Dorney 1954).

These wetlands are important for reptiles and amphibians. Northern leopard frogs, boreal chorus frogs, and Canadian toads breed in semi-permanent wetlands (Cook 1966) and then disperse to adjacent moist uplands for the rest of the summer (Kantrud *et al.* 1989a). Northern leopard frogs and western painted turtles may hibernate over the winter months in the mud at the bottoms of these and permanent wetlands.

3.3.1.5 Permanent Basins

A variety of diving ducks, such as redhead, canvasback, and ruddy duck, may also occur. These species forage in the open water zone and nest in peripheral emergent growth. One species of dabbling duck, the green-winged teal, is a common summer resident of permanent wetlands in parkland regions. The stable water levels of these wetlands may be important for migrant waterfowl because they provide stopover habitats with more reliable water levels for resting purposes. The presence of peripheral wetland zones with vegetation characteristic of temporary, seasonal, and semi-permanent basins will result in greater vegetation diversity and increased utilization by wildlife species.

If fish are present, the central open water zones may be frequented by western grebes and Forster's tern that prey upon them and nest on platforms of vegetation concealed in coarse emergent stands along the shoreline. White-winged scoters may also occur if there is considerable open water and shrub-covered shorelines for nesting. Common terns and white-winged scoters prefer to nest on islands, therefore the presence of islands may make these habitats more attractive for these species.

There is often a ring, or partial ring of aspen or balsam poplar along the perimeter of these wetlands. Trees large enough to contain large cavities may attract cavity-nesting ducks such as wood duck, common goldeneye, bufflehead, common merganser, and hooded merganser. The latter two species specialize in pursuing and capturing small fish underwater.

Although many mammals use these wetlands for drinking and bathing, semi-aquatic mammals such as mink, muskrat, and beaver occur regularly in these lakes. Beaver will only be present if there are enough mature trees in adjacent areas, such as along riparian zones associated with outlet streams. These wetlands are also important to northern leopard frogs and western painted turtles that overwinter in the mud at bottom of the basin, and to tiger salamanders for breeding (Cook 1966).

3.3.1.6 Artificial Basins

Artificial basins are most likely used by wildlife, as they are for cattle, as reliable sources of bathing and drinking water, and are therefore visited infrequently by mammal and bird species for this purpose. Occasionally, waterfowl and shorebirds may visit these areas for foraging or resting purposes, and ducks may bring newly hatched ducklings to these basins. Killdeer, willet and marbled godwit sometimes nest in the vicinity of dugouts.

These ponds also provide important habitat for aquatic tiger salamander larvae, particularly during periods of drought (A. Didiuk, CWS, *pers. comm.*). Piles of excavated soil that surround dugouts and cutbanks created by the excavation of borrow pits and gravel pits are often used by burrowing mammals such as Richardson's ground squirrel, badger, and red fox. Colonial-nesting bank swallows often dig their short nest burrows into cutbanks, and in substrate piles if they are steep enough. These pilings are often bare of vegetation due to cattle activity and poor moisture retention. They are regularly used for perch sites by birds of prey such as the red-tailed and Swainson's hawk in summer, and by snowy owls during the winter months.

Sewage lagoons varying in size are found throughout the Basin. Unlike other artificial wetlands, the extremely nutrient-rich waters of sewage lagoons are important to both migrant and resident species of waterfowl and shorebirds for foraging, staging, nesting, and brood-rearing (Belanger 1994). The relatively stable water levels discourage the establishment of emergent vegetation, which precludes the presence of most marsh-nesting birds. The abundance of waterfowl nesting in the vicinity of these wetlands likely attracts striped skunks, and raccoons, while the abundance of shorebirds during spring and fall migration also attracts raptors, such as peregrine falcon and its smaller relative, the merlin, that specialize in capturing birds in flight.

3.3.1.7 Riparian Wetlands

The main tree species along watercourses are trembling aspen, balsam poplar, and white birch. The bur oak is widespread but locally distributed along the Assiniboine River throughout the southern half of the Basin (Adam *et al.* 1982) and stands of green ash can be found on the floor of the river valley. Understory vegetation is composed of shrubs such as Wood's rose, red-osier dogwood, beaked hazelnut, choke cherry, Saskatoon, river alder, western snowberry, and high-bush cranberry, and a herbaceous layer that includes northern bedstraw, two-leaved Solomon's seal, bunchberry, twinflower, tall lungwort, and dewberry. Ostrich ferns occur on poorly drained sites within riparian wetlands.

Some poorly-drained sites along the slopes of the Assiniboine River upstream from Lake of the Prairies contain vegetation communities more typical of boreal forests to the north (Adam *et al.* 1982). These may support localized populations of tamarack trees and shrubs such as Labrador tea and shrubby cinquefoil, and herbs such as glaucous grass-of-parnassus, cloudberry, and Kalm's lobelia. Tamarack and Labrador tea are believed to reach the southern limits of their Saskatchewan ranges in this area (Adam *et al.* 1982).

A wide diversity of bird species can be found in these riverine habitats. Great blue herons that frequent the banks of these watercourses prey upon fish, amphibians and crayfish. Spotted sandpipers are found along rocky shores and beaver ponds, nesting in adjacent shoreline vegetation. If tree cavities are large enough, tree-nesting ducks such as wood duck, common goldeneye, bufflehead, common merganser, and hooded merganser may breed. Tree swallows and belted kingfishers nest in tree cavities along permanent watercourses. Along with bank swallows, kingfishers will also dig short nest burrows in eroded cutbanks along creeks and rivers.

Mature aspen forests along riparian corridors provide habitat for ruffed grouse, red-headed woodpecker, northern flicker, eastern wood-pewee, red-eyed vireo, veery, black and white warbler, American redstart, and white-throated sparrow. Alder flycatcher, cedar waxwing common yellowthroat, nashville warbler, northern waterthrush, song sparrow, and swamp sparrow will inhabit dense stands of shrubs and willows that are located between riparian wetlands and wooded uplands. Shrubby slopes along the banks of creeks and rivers in the northeastern portion of the Basin may be inhabited by the rare golden-winged warbler (E. Cumming, formerly CWS, *pers. comm.*). Bridges over creeks and rivers are commonly used as nesting sites for eastern phoebes and colonial-nesting cliff swallows. This habitat may be important to fruit-eating birds in winter, such as the bohemian waxwing and pine grosbreak, due to the diversity of fruit-bearing trees and shrubs.

Bird surveys were conducted in riparian woodland habitat in Aessippi Provincial Park at the south end of Lake of the Prairies during the summer of 1993 to assess the importance of this park for the yellow-throated vireo (W. Koonz, Manitoba Conservation, *pers. comm.*). This study concluded that this area provided substantial habitat for this species which approaches the northwestern limit of its range in this area. Eighty-seven additional bird species were recorded during surveys conducted over two days. In addition to the wide diversity of birds, 11 species of mammals, one species of reptile, and three species of amphibians were also recorded, reflecting the abundant productivity of wildlife in these riparian woodlands.

More open, grassy slopes on the banks of creeks and rivers provide habitat for the ground-nesting common nighthawk. Named for its proficiency at "hawking" insects on the wing during the night, this well-camouflaged species often sits motionless on the ground or horizontally on a tree branch during the daylight hours.

Open grassy areas with wooded borders provide edge habitats where different vegetation communities meet. These communities often blend along their borders, resulting in what is known as an ecotone. Edges and ecotones often contain extremely high numbers of wildlife species because of the combination of species characteristic of each different vegetation type. Consequently they are utilized by many wildlife species. An ecotone between grassland and a woodland, for example, may offer a woodland species such as the snowshoe hare, an opportunity to browse the tender shoots of newly emerged saplings with rapid access to adjacent dense woodland cover if a predator were to appear. Similarly, a grassland species such as the vesper sparrow may utilize an elevated perch in a young aspen tree along a woodland border to broadcast its territorial song.

The beaver is extremely important in its effects on riparian ecosystems. Johnson and Naiman (1987) consider the beaver as a keystone species since its influence on the ecosystem goes well beyond its requirements of food and living space. Dams constructed across streams and rivers slow the flowing water and cause sediment and debris to be deposited behind them. The dams may alter the hydrology and nutrient cycling in a stream, or perhaps even an entire river system. Elmore and Beschta (1987) suggest that removal of beaver and associated dams may result in downstream erosion from increased water flow. It has even been suggested that thousands of years of beaver activity may have created many of the west's fertile valleys (Kay 1994). Therefore, the activities of the beaver, like those of the muskrat in basin wetlands, have profound effects on other wildlife that share this habitat with these large rodents.

The little brown bat, northern myotis and red bat forage for flying insects at night over open water along watercourses and adjacent forests. Abandoned woodpecker holes, bark crevices, and the undersides of bridges are used for diurnal roosting sites (Pattie and Hoffmann 1992). Rodents such as least chipmunk, red squirrel, and woodchuck inhabit riverine forests. Other upland wildlife species depending heavily upon riparian zones for food and shelter include the black bear, coyote, raccoon, white-tailed deer, and moose.

The western painted turtle and northern leopard frog inhabit slow-moving creeks and rivers that have adjacent submerged vegetation. Shallow pools along these waters may contain large numbers of leopard frog tadpoles. The banks of riparian zones are important hunting areas for garter snakes, while adjacent moist wooded uplands provide foraging habitat for the wood frog. Small cavities, crevasses, and fissures often associated with dead or dying tree root systems, are used for dens known as hibernacula by garter snakes in winter.

Oxygen-rich water flowing in permanent creeks and rivers often support fish populations, which attract fish-eating species such as great blue heron, osprey, belted kingfisher, and mink. River otters may inhabit the more northern portion of the Assiniboine River and its associated tributaries. The diminutive and semi-aquatic water shrew also inhabits the banks of streams in the northern part of the Basin where it dives into fast-flowing waters in search of aquatic insects.

Mollusks are common aquatic invertebrates in the Assiniboine River and its tributaries. Clarke (1981) classified the Red River-Assiniboine River Region as one of nine distinct zoogeographic mollusk distribution regions in Canada. The different life cycle stages of these mussels are an important food source for aquatic and semi-aquatic mammals and birds, as well as fish. Fish are important to mussel populations because several fish species serve as hosts for developing mussel larvae, known as glochidia.

There is growing pressure from the freshwater mussel industry to implement commercial harvesting of the three ridge mussel, the only commercially viable species known to occur, in this portion of the river. Although no data are available for the Basin, mussel surveys along the Assiniboine River to the southeast near Portage la Prairie, Manitoba indicate the presence of at least eight species (Scaife and Janusz 1992). These surveys determined that population densities of three ridge mussels in the Assiniboine River appear to be too low to support an economically viable commercial harvest. Janusz (1992) found that populations of three ridge mussels in this portion of the river have some of the oldest individuals found anywhere, likely because they have never been harvested. Twenty-five percent of the population was found to be over 84 years of age, and one specimen was determined to be 231 years old, the oldest on record for this species. Scaife and Janusz (1992) recommended that the three ridge mussel, due to its long-lived and sedentary nature, has the greatest value as a scientific indicator of the environmental impacts of man-made structures such as dams, bridges, and treatment plants.

Aquatic invertebrates are also important components of riparian biodiversity because they provide nourishment for many wildlife species that forage along these watercourses. Crayfish inhabit all permanent streams, as well as larger, sand and gravel-bottomed lakes. In addition to scavenging, crayfish feed on abundant insect larvae and other invertebrates, and are preyed upon by herons, kingfishers, mink, and raccoon (Bird 1961, Welder 1994). Insects found in these waters that are preyed upon by a variety of wildlife species include the black fly, stonefly, caddisfly, mayfly, water boatmen, and water striders.

3.3.1.8 Lakes

Lakes that contain stable fish populations will attract fish-eating birds such as the western grebe, Forster's tern, and common tern. If coarse emergent vegetation is adequate for nest concealment these species will forage in the open water zone and build their platform nests in these emergent stands. Vegetated shorelines offer shelter and cover for shore-nesting species such as the common loon and white-winged scoter. The common loon is very sensitive to disturbance from human activities and is likely an uncommon to rare breeding species in the few permanent freshwater lakes within the Basin that support fish populations. Smith (1996) lists several confirmed and probable breeding records for these loons throughout the Basin. American white pelicans and double-crested cormorants may be found foraging for fish in these waters as non-breeding summer residents, or as visitors from distant nesting colonies. The nearest known pelican and cormorant breeding colonies are located at Mud Lake, situated between Little Quill Lake and Big Quill Lake, 35 km west of the Basin west boundary. Six surveys of these colonies between 1976 and 1991 resulted in an average of 329 pelican nests and 69 cormorant nests (Roney and Hlady 1984, Roney and Longmuir 1993). The maximum number of nests for each species was 655 for pelicans (1980), and 267 for cormorants (1976). Waterfowl bait pads in lakes such as Crescent Lake and Leech Lake are often used as resting areas for pelicans (R. Kirkness, Sask Water, *pers. comm.*).

If shoreline trees are large enough, such as those that surround Fishing Lake, Horseshoe Lake, and Good Spirit Lake, they may be used by the colonial-nesting great blue heron. Bald eagles and osprey also nest in mature shoreline trees along large lakes and rivers. Although typically found breeding further north in the boreal forest ecoregions, Smith (1996) reported confirmed breeding for the bald eagle, and probable breeding for the osprey, on the southern edge of the Duck Mountains in the northeast portion of the Basin. Bald eagles also frequent larger lakes in the Basin in late fall, patrolling the shores in search of waterfowl crippled by hunters.

While lakes are important to mammals for the purpose of drinking and bathing, few species actually inhabit them. Beaver and mink are the only species that typically occur. River otter may inhabit some lakes in the northern reaches of the Basin, especially if they are fed by outlet streams to major rivers. Crayfish, very common in these lakes, are heavily preyed upon by herons, kingfishers, mink, raccoons, and otters (Greer 1955), if they are present. Moose are known to feed on aquatic vegetation in the shallows of these lakes as well as in slow-moving creeks and rivers.

3.3.1.9 Uplands

The most diverse group of birds that utilize contiguous wooded upland habitat is the songbirds. Approximately 43 percent of the songbird species known to breed in the Basin are known as neotropical songbirds. These species typically breed in Canada and the northern United States and winter far to the south in tropical areas such as the West Indies, Central America, and South America. Many neotropical species breed in woodland habitats within the Basin including the great crested flycatcher, Philadelphia vireo, red-eyed vireo, Swainson's thrush, mourning warbler, Connecticut warbler, ovenbird, American redstart, Baltimore Oriole and rose-breasted grosbeak. Other species that breed here but do not winter as far south include the hermit thrush, purple finch, and white-throated sparrow. In addition to these breeding species, vast numbers of neotropical species that breed in boreal forests further to the north pass through these wooded habitats during spring and fall migration, often stopping over for a day or more when it is necessary for them to replenish their energy supplies.

Mammals such as Gapper's red-backed vole, least chipmunk, woodchuck, red squirrel, northern flying squirrel, big brown bat, hoary bat, and snowshoe hare are common denizens of these woods. Although the fox squirrel is found in riparian woods further south, such as those along the Souris River, one individual was trapped in the woods in the vicinity of Stove Creek during the winter of 1982-83 (Adam 1984). The trapper had apparently seen a number of other individuals in the area around this time which suggests that these squirrels had expanded their range to the northwest along the Assiniboine River (Adam 1984). The present status of fox squirrels in the Basin is unknown. Another squirrel more typically found in areas to the southeast, the eastern gray squirrel, also appears to be expanding into wooded regions of the Basin. Individuals have been reported recently from Yorkton and the Good Spirit Lake area (A. Schmidt, SERM, *pers. comm.*). It is possible that the presence of these two species of rodents are the result of human introduction.

Larger mammals present here include the omnivorous black bear and coyote, as well as browsing ungulates such as moose, elk, and white-tailed deer. Red-sided garter snakes, wood frogs, boreal chorus frogs, and Canadian toads occur here regularly (Preston 1982), especially if there are wetlands nearby. These amphibians forage for invertebrates that are plentiful on the forest floors and along the edges of these forests.

Mixed-wood boreal forests contain the greatest diversity of breeding bird species of all ecosystems in North America (Smith 1980). In addition to bird communities also found in deciduous woods, many other neotropical songbird species may occur such as olive-sided flycatcher, western wood-pewee, blue-headed vireo, and a variety of warblers including yellow-rumped, magnolia, cape may, bay-breasted, black-throated green, and Canada warbler. Other resident species and short distance migrants inhabiting these mixed forests include barred owl, gray jay, red-breasted nuthatch, boreal chickadee, brown creeper, ruby-crowned kinglet, and white-winged crossbill. In addition to mammals found in deciduous woods, these mixed-wood stands may also support small populations of boreal forest mammals such as northern myotis, arctic shrew, heather vole, wolf, fisher, pine marten, and lynx.

3.3.1.10 Small, Isolated Woodlands

Small stands of deciduous trees, commonly known as "bluffs", are typically found in areas of intensive agriculture in the southern portion of the Basin. These are mainly composed of trembling aspen and willow and often border wetlands or occur as isolated patches in farmland. The presence of woody vegetation around prairie wetlands is believed to be the result of fire suppression by prairie farmers (Bird 1961). Although aspen woodlands have likely increased in area because of fire suppression, historical records show that aspen were present in this region.

These woodlots are regularly inhabited by birds such as the Cooper's hawk, red-tailed hawk, mourning dove, long-eared owl, black-billed cuckoo, least flycatcher, house wren, brown thrasher, mountain bluebird, warbling vireo, and Baltimore oriole. The parasitic brown-headed cowbird is a common inhabitant of these woodlots. The cowbird traditionally followed nomadic herds of bison throughout the Great Plains, laying their eggs in the nests of other birds nests which enabled them to keep up with the constantly moving herds. With the demise of the bison, cowbirds have adapted very well to human changes in the landscape and are now much more sedentary. As a result they have become much more common and widespread, and cowbird nest parasitism has been implicated in the decline in productivity of many songbird species across North America (Lowther 1993). Mammals found in these small woodlots include the Franklin's ground squirrel, Gapper's red-backed vole, deer mouse, snowshoe hare, and porcupine (Pattie and Hoffmann 1992). Red squirrels, although more common in larger and more contiguous tree stands, are often found in these fragmented woods where they can be significant predators on the nests of ground-nesting birds (Bayne and Hobson 1997). Red-sided and western plains garter snakes forage in these woodlands, especially if wetlands are nearby.

3.3.1.11 Shrubs

The shelter afforded by shrubs is important to the white-tailed jackrabbit and Franklin's ground squirrel. Patches of shrubs in native grasslands provide important nesting habitat for mallard, gadwall, and American widgeon (Trottier 1992). Songbirds nesting in shrubby grassland habitat and on the borders of mature woods and wetlands include eastern kingbird, gray catbird, yellow warbler, common yellowthroat, indigo bunting, American goldfinch, and clay-coloured sparrow. Garter snakes, wood frogs, and Canadian toads may occasionally forage in shrubby areas.

3.3.1.12 Grasslands

Wildlife use of native grassland is dependent upon vegetation height and structure which is affected by different grazing practices. Native prairie grasslands interspersed with shrubby growth provide nesting habitat for dabbling ducks. Mallard, American widgeon, and gadwall typically nest in patches of grass and shrubs, while northern pintail, northern shovelor, and blue-winged teal nest in patches of grass and forbs (Trottier 1992). Songbirds nesting in native grasslands include upland sandpiper, horned lark, Sprague's pipit, western meadowlark, chestnut-collared longspur, Baird's sparrow, vesper sparrow, and grasshopper sparrow. Table 3.7 lists some grassland bird species and their habitat preferences in response to grazing practices.

Table 3.7 - Habitat Preferences of Some Grassland Bird Species with Respect to Grazing Practices That Occur in the UARB (adapted from Trottier 1992)

TALL, DENSE GRASSLAND (LIGHT OR NO GRAZING)	MEDIUM HEIGHT GRASSLAND (MODERATE GRAZING)	SHORT GRASSLAND (HEAVY GRAZING)
Savannah Sparrow	Sharp-tailed Grouse	Killdeer
Baird's Sparrow	Upland Sandpiper	Horned Lark
Clay-coloured Sparrow	Willet	
Grasshopper Sparrow	Sprague's Pipit	
Le Conte's Sparrow	Western Meadowlark	

The sharp-tailed grouse, Saskatchewan's provincial bird, establishes dancing grounds known as leks, on elevated areas of native prairie during the breeding season. Isolated trees, mainly aspen, or clumps of willow that develop in moist depressions may attract nesting Swainson's hawks, western kingbirds, eastern kingbirds, and loggerhead shrikes. Mountain bluebirds frequent grasslands that border wooded areas in which they breed.

Grassland mammals include inconspicuous species such as Hayden's shrew, prairie vole, meadow jumping mouse, northern pocket gopher, meadow vole, and long-tailed weasel. More conspicuous species include white-tailed jackrabbit, Richardson's ground squirrel, badger, coyote, and the ubiquitous red fox and striped skunk. The red-sided garter snake, western plains garter snake, and Canadian toad are often found here, especially if there are wetlands nearby. These three species, along with tiger salamanders, are known to overwinter in crevasses, abandoned rodent burrows, and ant hills found in grassland areas (Preston 1982; Cook 1966).

3.3.1.13 Tame Forage

Waterfowl species, such as mallard, northern shovelor, and American widgeon often nest in hay fields adjacent to wetlands. Although avoided by most typical grassland birds, vesper sparrow, savannah sparrow, Baird's sparrow, and clay-coloured sparrow, as well as western meadowlark and bobolink sometimes nest in these fields. The nests of these species are often destroyed by haying activities during the summer. Studies on the mortality risk to nesting waterfowl during mowing of forage have shown that hen mortality can be very high in hay fields. Five years of research found that mowing killed on average about on third of the hens nesting in the monitored forage fields. When wildlife-flushing bars were used, hen mortality decreased to about 10 percent (M. Kornder, DU, *pers. comm.*). Fawns are also at risk from haying operations because they "stay put" once they are placed in hiding cover by their mothers.

Rodents such as the deer mouse and the meadow vole also use these crops and are preyed upon by the coyote, red fox, and various birds of prey. During years of high meadow vole populations, these fields can support concentrations of rodent-eating hawks and short-eared owls, and in winter, snowy owls. This plentiful food supply may cause migratory species such as the rough-legged hawk, northern harrier, and short-eared owl to remain longer than usual into the fall. Northern pocket gophers also occur in tame forage where they dig their subterranean tunnel networks and feed on tender plant roots. These areas are largely avoided by reptiles and amphibians due to the lack of standing water and lower abundance of prey items.

3.3.1.14 Croplands

Towards the end of May, as farmers are seeding cultivated fields, arctic-bound shorebirds such as American golden-plover and buff-breasted sandpiper forage extensively in fields for protein-rich invertebrates. Freshly burned stubble fields are also attractive for these species. Black-bellied plover often accompany these flocks, but seem to prefer fields that are flooded with spring meltwater.

Other arctic-bound bird species foraging in fields during spring and fall migration include large flocks of lapland longspurs, snow buntings, American pipits, and arctic populations of horned larks. Several species of gulls are also known to forage for invertebrates in tilled fields, often following farm equipment. Red-winged blackbird, yellow-headed blackbird and brewer's blackbird forage in croplands adjacent to breeding habitat. Croplands are used in winter by foraging gray partridge, sharp-tailed grouse, common redpoll, and snow bunting.

Croplands in the vicinity of large wetlands used as staging areas by waterfowl are subject to crop depredation. Crop predation by waterfowl caused little economic loss to farmers (Clark and Sugden 1986) compared to other impacts on the agricultural industry such as insects, weeds and disease (Arsenault 1994). It has been found that harvest duration (days in swath) and proximity of susceptible crops to staging wetlands are the major factors influencing crop damage by waterfowl (Jakimchuck 1969; Clark *et al.* 1993; Arsenault 1994). Croplands used to grow wheat and barley are used by whooping cranes during their migration between their breeding grounds in northeastern Alberta and southern Texas (Howe *draft report*). These croplands are widely distributed through most of the whooping crane migration corridor. Sandhill cranes also exploit these croplands (Hoffman 1976; Melvin 1982; Burke 1996).

Few bird species nest in croplands. Species that favor barren habitats such as killdeer and horned lark will occasionally nest on the bare ground in these fields soon after croplands are seeded and before seedlings mature. Later when the crop has formed a canopy, a few other bird species, such as western meadowlark and vesper sparrow, may occasionally nest. Upland nesting waterfowl are known to nest in higher densities in fall seeded cereal crops than in conventionally seeded spring cereal crops. A study near Yorkton found one nest per nine acres of winter wheat/fall rye compared to one nest per 45 acres of spring seeded cereal crop (Kornder *et al.* 1998). Ducks Unlimited is currently investigating different agricultural production systems to determine which systems benefit wildlife and are agronomically and economically beneficial for producers (M. Korndcr, DU, *pers. comm.*).

Few mammal species dwell in these fields for extended periods of time. Deer mice, meadow voles, Richardson's ground squirrels, white-tailed jackrabbits, and white-tailed deer may forage in cropland, especially if there is more suitable adjacent habitat available for cover. If there are barren patches, such as on eroded areas on steep hillsides, Richardson's ground squirrels may establish small colonies. The red fox and the badger may also dig burrows in these areas. The lack of standing water and prey limit the use of these areas by reptiles and amphibians.

3.3.1.15 Summary of Use of Wetlands and Uplands Habitat by Wildlife

Wapple (1999) identified the use of wetlands and uplands for breeding and foraging habitat by birds, mammals, amphibians and reptiles. Table 3.8 presents a summary of the use of habitat type for breeding. The number of mammal, bird, reptile and amphibian species known or suspected to breed in each habitat type is listed followed by the percentage of the total number of species within each respective order that are known or suspected to breed in the Basin. For example, the eight species of mammals known or suspected to breed in habitats associated with temporary basins represents 17 percent of the total number of mammal species known or suspected to breed in the Basin.

Basin wetlands support equal percentages (30 %) of breeding bird and mammal species. Within basin wetland types, seasonal basins support the greatest diversity of breeding mammal species (22 %) while seasonal and semi-permanent basins support the greatest diversity of breeding birds (23 %). Basin wetlands are very important to amphibians and reptiles, with 80 percent of reptiles and all amphibian species utilizing these habitats for breeding.

Riparian wetlands are important breeding habitat for a large proportion of wildlife species occurring in the Basin with 50 percent of mammal species, 21 percent of bird species, and 80 percent of amphibian and reptile species, respectively, known or suspected to breed in these habitats. Permanent riparian wetlands support a greater diversity of breeding fauna than intermittent riparian wetlands. Lakes are of little importance to breeding mammals but are used by 29 percent of breeding birds species, 67 percent of breeding reptile species, and 80 percent of breeding amphibian species. Lakes with vegetated shorelines support a greater diversity of breeding fauna than lakes with exposed shorelines.

Wooded, shrubby and native prairie uplands support a great diversity of breeding birds (68 %), mammals (85 %) and reptiles (67 %) but are not used by breeding amphibians. Of these upland types, wooded uplands support the highest diversity of breeding fauna. Forage and cereal croplands are of the least importance of all habitats for breeding wildlife. Only 13 percent of mammal species, and 9 percent of bird species use these habitats for breeding. No amphibians or reptiles breed in these croplands.

Table 3.8 - Wildlife Breeding Habitats in the Upper Assiniboine River Basin

Habitat Type	No. of Mammal Species	No. of Bird Species	No. of Reptile Species	No. of Amphibian Species
Temporary Basin	8 (17 %)	23 (12 %)	2 (67 %)	5 (100 %)
Seasonal Basin	10 (22 %)	43 (23 %)	3 (100 %)	5 (100 %)
Semi-permanent Basin	5 (11 %)	43 (23 %)	3 (100 %)	5 (100 %)
Permanent Basin	5 (11%)	41 (22 %)	3 (100 %)	4 (80 %)
Artificial Basin	0 (0 %)	17 (9 %)	2 (67 %)	4 (80 %)
Total	*14 (30 %)*	*56 (30 %)*	*3 (100 %)*	*4 (80 %)*
Intermittent Riparian	**18 (39 %)**	**24 (13 %)**	**3 (100 %)**	**4 (80 %)**
Permanent Riparian	**23 (50 %)**	**39 (21 %)**	**3 (100 %)**	**4 (80 %)**
Total	***23 (50 %)***	***39 (21 %)***	***3 (80 %)***	***4 (80 %)***
Exposed Shoreline Lake	0 (0 %)	18 (10%)	0 (0 %)	4 (80 %)
Vegetated Shoreline Lake	4 (9 %)	45 (24 %)	2 (67 %)	4 (80 %)
Total	*4 (9 %)*	*55 (29 %)*	*2 (67 %)*	*4 (80 %)*
Wooded Upland	**29 (63%)**	**99 (53 %)**	**2 (67 %)**	**0 (0 %)**
Shrub Upland	**13 (28 %)**	**33 (18 %)**	**0 (0 %)**	**0 (0 %)**
Native Grassland Upland	**18 (39 %)**	**33 (18 %)**	**2 (67 %)**	**0 (0 %)**
Total	***39 (85 %)***	***128 (68 %)***	***2 (67 %)***	***0 (0 %)***
Tame Forage Upland	6 (13 %)	16 (8 %)	0 (0 %)	0 (0 %)
Cropland Upland	5 (11 %)	13 (7 %)	0 (0 %)	0 (0 %)
Total	*6 (13 %)*	*17 (9 %)*	*0 (0 %)*	*0 (0 %)*

Table 3.9 summarizes foraging habitat utilization by wildlife species in the Basin. The number of mammal, bird, reptile and amphibian species known or suspected to forage in each habitat type is listed followed by the percentage of the total number of species within each respective order that occur in the Basin. For example, the 23 species of mammal known to forage in habitats associated with temporary basins represent 47 percent of the total number of mammal species that occur in the Basin.

Basin wetlands are important foraging habitats for many wildlife species in the Basin with 54 percent of mammal species, 35 percent of bird species, and all reptile and amphibian species known to occur in the Basin foraging in habitats associated with these wetlands. Riparian wetlands are used for foraging by 60 percent of mammal species, 26 percent of birds and all reptiles and amphibians that occur in the Basin. Lakes are used for foraging by 25 percent of mammal species, 37 percent of bird species, 67 percent of reptile species and all amphibian species that occur in the Basin.

Table 3.9 - Wildlife Foraging Habitats in the Upper Assiniboine River Basin

Habitat Type	No. of Mammal species	No. of Bird Species	No. of Reptile Species	No. of Amphibian Species
Temporary Basin	23 (47 %)	79 (33 %)	3 (100 %)	5 (100 %)
Seasonal Basin	24 (49 %)	92 (38 %)	3 (100%)	5 (100 %)
Semi-permanent Basin	13 (27 %)	95 (39 %)	3 (100 %)	5 (100 %)
Permanent Basin	14 (29 %)	77 (32 %)	3 (100 %)	5 (100 %)
Artificial Basin	5 (10 %)	55 (23 %)	3 (100 %)	5 (100 %)
Total	*26 (54 %)*	*86 (35 %)*	*3 (100 %)*	*5 (100 %)*
Intermittent Riparian Wetland	26 (53 %)	55 (23 %)	3 (100 %)	5 (100 %)
Permanent Riparian Wetland	29 (59 %)	64 (26 %)	3 (100 %)	5 (100 %)
Total	***29 (60 %)***	***64 (26 %)***	***3 (100 %)***	***5 (100 %)***
Exposed Shoreline Lake	10 (20 %)	79 (33 %)	0 (0 %)	5 (100 %)
Vegetated Shoreline Lake	12 (24 %)	63 (26 %)	2 (67 %)	5 (100 %)
Total	*12 (25 %)*	*90 (37 %)*	*2 (67 %)*	*5 (100 %)*
Wooded Upland	31 (63 %)	116 (48 %)	2 (67 %)	2 (40 %)
Shrub Upland	17 (35 %)	47 (19 %)	2 (67 %)	2 (40 %)
Native Grassland Upland	24 (49 %)	55 (23 %)	2 (67 %)	2 (40 %)
Total	***43 (90 %)***	***155 (64 %)***	**2 (67 %)**	***3 (60 %)***
Tame Forage Upland	10 (20 %)	52 (21 %)	0 (0 %)	0 (0 %)
Cropland Upland	10 (20 %)	55 (23 %)	0 (0 %)	0 (0 %)
Total	*10 (21 %)*	*55 (23 %)*	*0 (0 %)*	*0 (0 %)*

Wooded, shrubby and native prairie uplands provide foraging habitat for 90 percent of mammal species, 64 percent of bird species, 67 percent of reptile species, and 60 percent of amphibian species known to occur in the Basin. Forage and cereal croplands provide foraging habitat for 21 percent of mammal species and 23 percent of bird species known to occur in the Basin. No reptiles or amphibians are known to forage in these habitats.

Large differences in the number of species utilizing habitats for breeding and foraging demonstrate that many species have specific breeding habitat requirements but utilize a variety of foraging habitats. The number of bird species foraging in some habitats is magnified due to the presence of foraging bird species that migrate through the Basin but do not remain to nest. Arctic-bound shorebirds, for example, considerably increase the number of bird species foraging on lakes with exposed shorelines compared with the number of bird species that breed there.

3.3.2 Rare, Threatened and Endangered Species

Rare, threatened, and endangered species are categorized by a variety of agencies, each with its own criteria. Those mentioned here include the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and Manitoba and Saskatchewan Conservation Data Centres. The COSEWIC determines the national status of wild species, subspecies, varieties and nationally significant populations that are considered to be at risk in Canada (COSEWIC 1998).

In its 1998 report, the committee determined that four species of breeding or formerly breeding birds, one amphibian and one butterfly occurring in the Basin are 'at risk'. Manitoba Conservation and Saskatchewan Environment and Resource Management have similar designations for provincially threatened, endangered, extirpated and extinct species. The Saskatchewan Conservation Data Centre and Manitoba Conservation Data Centre have S1 (very rare) and S2 (rare) provincial designations for rare and endangered species. Rare plants follow criteria of Harms *et al.* (1992), Manitoba Conservation Data Centre and Saskatchewan Conservation Data Centre.

Brief summaries of these species expected to be found in the Basin are provided below. More detailed information is in Wapple (1999), Appendix I.

3.3.2.1 Whooping Crane (endangered)

The whooping crane no longer breeds in the Basin, or anywhere else on the Prairies. Although the main migratory route between their breeding grounds in Wood Bison National Park in northern Alberta and their wintering grounds in southeast Texas lies to the west of the Basin, they do occasionally migrate through the Basin. Of 1937 confirmed and probable whooping crane migration stopover records from across the Prairie provinces between 1910 and 1998, 41 (2.1 %) occurred within the Basin (Brian Johns, CWS, *unpub. data*) (see Wapple, 1999).

3.3.2.2 Piping Plover (endangered)

A 1996 survey of piping plovers found that nearly 8 percent of the North American breeding population of piping plovers were found on the nearby Quill Lakes (Skeel *et al.* 1996), but there are no recent breeding records from the Basin, and it likely occurs only during migration. Although the piping plover can occur as a migrant in the Basin, it is not important to this species.

3.3.2.3 Burrowing Owl (endangered)

A nest burrow was reported in the Theodore, Saskatchewan area in the late 1980s (B. Anaka, Yorkton, *pers. comm.*). Native prairie habitat that still exists in the Manitoba portion of the Basin may support small populations of these owls (K. De Smet, Manitoba Conservation, *pers. comm.*). The range contraction of this species and scant recent evidence of occurrence suggest the present range of the burrowing owl has contracted into southern areas and it likely no longer occurs in the Basin.

3.3.2.4 Loggerhead Shrike (threatened)

Shrike surveys conducted during the breeding season in 1987, 1991, and 1996 in the Yorkton area indicate that few, if any shrikes occur in the Basin and they are likely very rare in the Saskatchewan portion of the Basin due to the dominance of aspen parkland in the region (B. Johns, CWS, *pers. comm.*). They are most likely to be found in the southern portion of the Basin in the vicinity of native grassland with adjacent shrubbery or hedgerows for nesting. Breeding Bird Survey data from Smith (1996) indicate that there has been a highly significant (-5.9%) decline of loggerhead shrike populations in Saskatchewan on survey routes conducted between 1968 and 1992.

3.3.2.5 Ferruginous Hawk (vulnerable)

Evidence of this species in the Basin is scant. Houston (1949) described it as "Uncommon, though once a fairly common summer resident in open country; apparently its numbers have decreased considerably." Although Smith (1996) indicates no post-1966 breeding for the Saskatchewan portion of the Basin, populations appear to be slowly increasing across the rest of southern Saskatchewan. This is reflected by the S4 ranking assigned by the Saskatchewan Conservation Data Centre which is defined as common and demonstrably secure (Saskatchewan Conservation Data Centre 1998). An adult ferruginous hawk observed in potential breeding habitat near Shellmouth, on May 11, 1989, indicates that this species still possibly breeds in the remaining grasslands of the Manitoba portion of the Basin (K. De Smet, Manitoba Conservation, *pers. comm.*). While areas of native grassland habitat do exist in the southern portion of the Basin, the few recent area records for this species suggest that it is rare at best.

3.3.2.6 Short-eared Owl (vulnerable)

Within the Basin, the short-eared owls are likely uncommon residents of the larger, more expansive wetland complexes such as Barvas Marsh, east of Yorkton, and those south of Yorkton, and probably rare elsewhere within the Basin. During cyclic population climaxes of microtine rodents, this owl temporarily becomes a fairly common resident among wetland and native grassland habitats. Breeding Bird Survey data from Smith (1996) indicates that short-eared owls have decreased significantly (-2.7 %) on Saskatchewan survey routes between 1968 and 1992.

3.3.2.7 Northern Leopard Frog (vulnerable)

Northern leopard frog populations have decreased across Canada since the late 1970s (Russell and Bauer 1993), although the reasons are unknown. They have numerous mammalian and avian predators such as mink, raccoon, skunk, weasels, herons, bitterns, pelicans, and kingfishers. They are also susceptible to drought that causes their wetland habitats to dry out, leaving frogs attempting to hibernate in these areas vulnerable to freezing. This frog occupy wet woods, grasslands with adequate cover, and a variety of wetland types throughout the Basin but probably has a very localized distribution (A. Didiuk, CWS, *pers. comm.*).

3.3.2.8 Monarch Butterfly (vulnerable)

The monarch butterfly was designated as vulnerable in 1998 (COSEWIC 1998). This designation is defined as a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

Within the Basin, these butterflies are most likely found in moist riparian valley bottoms that either support milkweed or have it growing in adjacent areas. Since this species is migratory it may be observed almost anywhere during its migration.

3.3.2.9 Rare Plants

Harms *et al.* (1992) lists 31 plant species designated as rare in Saskatchewan. None of the rare plants designated as endangered or threatened by Manitoba Conservation and Saskatchewan Environment and Resource Management are found in the Basin. Distribution maps for the 31 rare plants are provided in Wapple (1999).

3.3.3 Feature Species

Feature species include those that may not be presently at risk, however they are of concern and are sometimes monitored due to their specific habitat associations or highly localized distributions and/or breeding locations. Colonial-nesting birds, for example, have very localized breeding locations that are vulnerable to both natural and human-related disturbance. More detailed descriptions of these feature species are found in Wapple (1999), Appendix I.

3.3.3.1 Great Blue Heron

Herons are often seen along permanent watercourses such as creeks and rivers in search of fish and less frequently in the vicinity of other less permanent water bodies where small rodents, amphibians, and snakes are taken as prey. Six known great blue heron colonies in the Basin are listed in Wapple (1999). Heron colonies are very sensitive to human disturbance, and often abandon their nests if disturbed. They are also vulnerable to high winds that may blow nests or young down to the ground, and to marauding raccoons that climb nest trees to gain access to the eggs and/or young.

3.3.3.2 Black-Crowned Night Heron

This heron nests in seasonal and semi-permanent marshes with abundant emergent growth, or in adjacent stands of trees, and forage widely from their breeding locations to feed on fish, amphibians, small snakes, and a variety of invertebrates. Their bulky nests are built in extensive stands of emergent growth, or in woods adjacent to wetland habitat. Nesting sites are provided in Wapple (1999).

3.3.3.3 American Bittern

This secretive heron inhabits a variety of wetland types that contain extensive emergent stands of cattail and bulrush where it patiently stalks passing prey that includes fish, amphibians, crayfish, and insects. Its guttural pumping song has earned this bird the nickname of "slough pump". Although bittern populations have recently been declining in Saskatchewan, along with much of the rest of North America, the American bittern is still a widespread breeding species in the Basin (Smith 1996).

3.3.3.4 Sandhill Crane

Sandhill cranes travel through the prairies in the spring and fall on their way to and from tundra wetlands where they breed. Southern populations formerly bred in the large marshes and wetland complexes throughout the parklands and prairies. Their breeding range was fragmented considerably following settlement due to intensive agricultural activities and it is now a rare and local breeding species in these regions (Smith 1996). Historic evidence indicates that this species was once a common breeding species within the Basin. Recent evidence of nests indicates this bird may breed in the Basin (Wapple 1999).

3.3.3.5 Yellow Rail

This extremely shy and secretive bird is found in fens and sedge marshes overgrown or nearly overgrown with coarse vegetation. Although widespread across the northern prairies and parkland regions of Saskatchewan, it is uncommon throughout its range (Smith 1996) and very little is known about its actual distribution in Saskatchewan. Its restricted habitat requirements make it vulnerable to drainage of temporary and seasonal wetlands that develop into suitable wet sedge meadow habitat. Recent surveys in the Barvas Marsh complex east of Yorkton found this species to be present throughout the breeding season (Kornder and Belcher 1996), which suggests that it may be a locally distributed breeding species in wet sedge meadow habitat within the Basin.

3.3.3.6 Franklin's Gull

Franklin's gulls are widespread as a summer resident throughout the Saskatchewan portion of the Basin but no nesting colonies are known (Smith 1996). Nesting in large semi-permanent marshes with plentiful emergent growth, these gulls construct platform nests of dead vegetation. Like other marsh-nesting birds, the localized breeding habitat of the Franklin's gull make it vulnerable to habitat loss through wetland drainage and habitat degradation resulting from drought.

3.3.3.7 Common Tern

The lack of suitable breeding habitat in the Basin limits the abundance of this species. Since fish are a highly preferred food, the best habitat for this species is likely associated with a few large, fish-inhabited lakes, such as Good Spirit Lake, and perhaps along the Assiniboine River and its adjacent wetlands. This species is still seen in the vicinity of Good Spirit Lake (B. Anaka, Yorkton, *pers. comm.*) and likely nests at or near the lake. Otherwise, it is likely an uncommon migrant and summer resident, and a rare and very local breeding species in the Basin.

3.3.3.8 Forster's Tern

Large permanent wetlands and semi-permanent wetlands during years of high water levels may support small breeding populations of this tern if these wetlands, or adjacent ones, contain fish. Like the common tern, a preference for fish as food is a limiting factor in their distribution within the Basin because of the relatively low number of lakes that contain fish and adequate marsh vegetation for nest sites. This species is more likely to breed in the Basin than the common tern. Forster's terns have been recently observed catching minnows at the south end of Good Spirit Lake and carrying them in a southeast direction, and breeding in this vicinity is likely (B. Anaka, Yorkton, *pers. comm.*).

3.3.3.9 Black Tern

Black terns are much more widespread than other terns in the Basin because they feed on invertebrates that are plentiful in a variety of wetland types, rather than fish. Their nests are constructed on platforms of emergent vegetation in loose colonies. Breeding Bird Survey data from Smith (1996) indicate a significant downward trend (-5.6 %) on Saskatchewan survey routes between 1968 and 1992.

3.3.3.10 Yellow-throated Vireo

Yellow-throated vireo surveys were conducted in Aessippi Provincial Park during the summer of 1993 to assess the possible effects of the construction of a proposed ski hill on wildlife populations. These surveys determined that this vireo was a rare and very local species in suitable woodland habitat within most of the park. The exception was in the actual area of the proposed ski hill where yellow-throated vireos were recorded "in large numbers during 1992 surveys" (B. Koonz *unpub. data 1993*). The lack of these vireos in similar habitat adjacent to the park suggests that this population is very localized and it would be extremely vulnerable to habitat alteration due to the development of this resort. This population likely represents the northwest limit of this species' range. Isolated populations of yellow-throated vireos may exist in suitable habitat further upstream along the Assiniboine River. The specific habitat requirements of this species combined with the fact that it is at or near the northwest limit of its range make it extremely vulnerable to habitat alteration that reduces the quality of breeding habitat and increases the ability of brown-headed cowbirds to parasitize its nests.

3.3.3.11 Golden-winged Warbler

This species requires regenerating old pastures and fields, gaps in deciduous forest, shrubby regrowth, and edges along streams (Confer and Knapp 1981, Curson *et al.* 1994) and appears to favor the early stages of regeneration within these habitats and once that stage is past, abandon the area (Confer and Knapp 1981). The golden-winged warbler has been reported in the Duck Mountain and Riding Mountain areas. The specific habitat requirements of the golden-winged warbler and its occurrence at or near the northwest limit of its range make it vulnerable to any habitat alteration and particularly that which increases the ability of brown-headed cowbirds to parasitize its nests (see Wapple 1999 for reported sitings).

3.3.3.12 Red-sided Garter Snake

This snake is widespread across parkland and forested areas of Saskatchewan while grassland populations are often scattered and local (Cook 1966). A variety of habitats are used by these snakes, but woodland habitats are favoured (Preston 1982). Garter snakes overwinter in communal dens known as hibernacula, usually located in cavities in the banks of streams and rivers, and often contain large numbers of snakes. Since large numbers of snakes congregate in these hibernacula, habitat alterations in their vicinity may have detrimental effects on the snake populations that use them.

3.3.4 Waterfowl

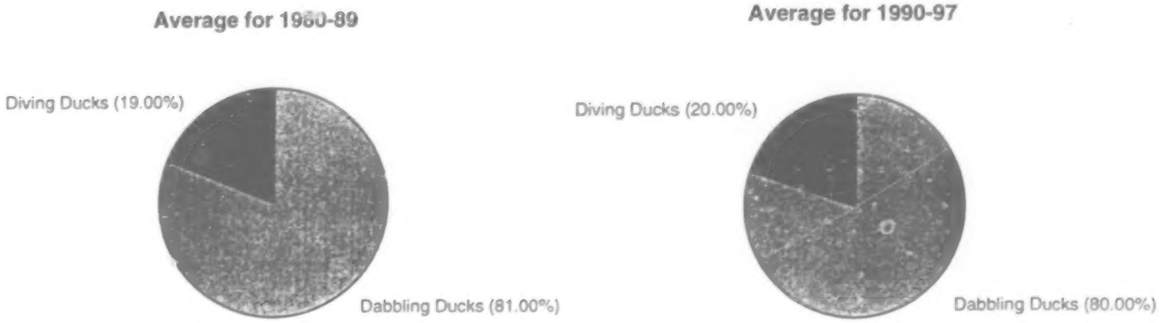
The Basin is considered to be an important waterfowl breeding area in prairie Canada. This is due to the variety and abundance of wetlands which provide nesting and brood-rearing habitat for many species of waterfowl.

3.3.4.1 Species Composition

Dabbling ducks are those ducks which primarily nest in upland habitats at varying distances from wetlands. They are capable of rapidly attaining flight from the surface of the water by "leaping" from the water with rapid and strong beats of their wings. Some diving ducks (e.g., bufflehead, goldeneye) nest in coarse thick emergent cover along the peripheries of wetlands. Other species of diving ducks nest in uplands relatively close to wetlands and some nest in tree cavities (e.g., mallard, blue-winged teal, pintail). Diving ducks must "run" along the surface of the water for considerable distance to attain flight.

Within the Basin, in the period 1980-1989 when water levels were greatly reduced in some areas of the southern Prairies, dabbling ducks comprised 81 percent, and diving ducks 19 percent of the total ducks counted (Canadian Wildlife Service and United States Fish and Wildlife Service data). During the period 1990-1997, when water conditions were improving in the southern Prairies, dabbling ducks comprised 80 percent and diving ducks 20 percent of the total ducks counted. The proportion of diving and dabbling ducks remained relatively constant between these two time periods, and this likely reflects the relatively more stable water levels within the Basin compared to other regions of the southern Prairies (Figure 3.15).

Figure 3.15
Proportion of Dabbling and Diving Ducks in the UARB, Average 1980-89 and 1990-97

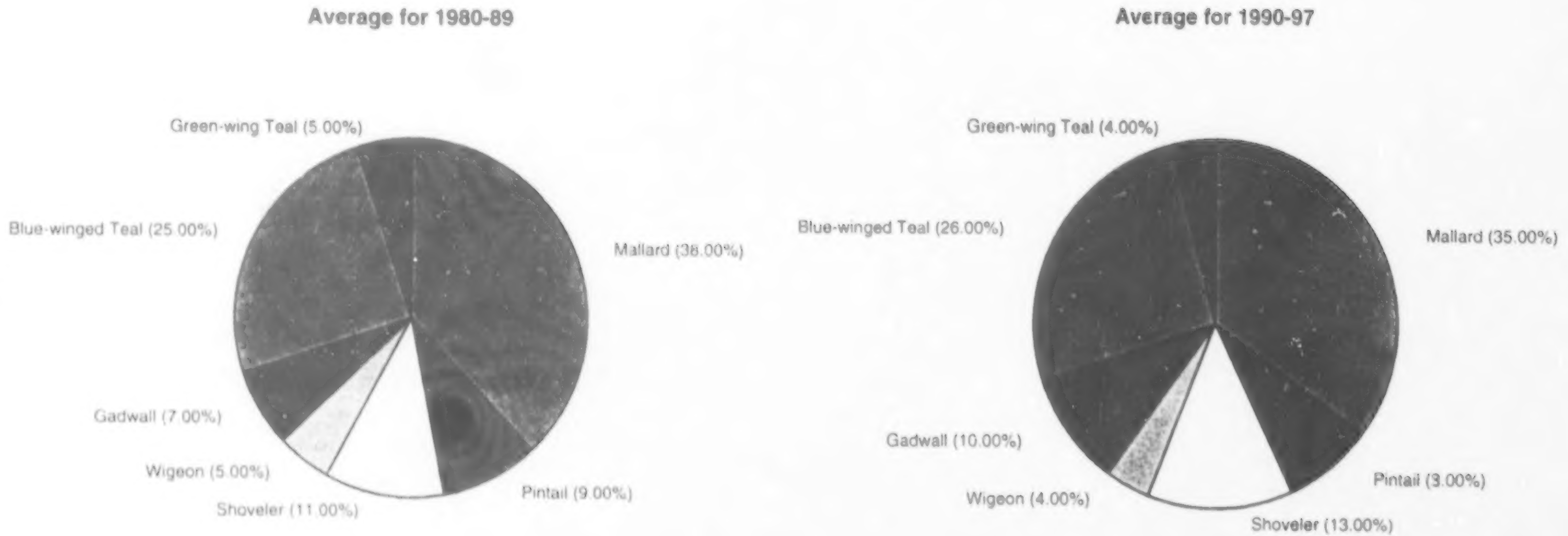


** Based on USFWS/CWS Aerial Surveys.*

There are seven species of dabbling ducks which breed within the Basin (Figure 3.16). The most abundant dabbling duck, during the period of 1980-1989, was the mallard (38%), closely followed by the blue-winged teal (25%). Other common dabbling ducks were the northern shoveler (11%), northern pintail (9%) and gadwall (7%). The American wigeon (5%) and green-winged teal (5%) were relatively uncommon within the Basin. During the 1990-1997 period, under improving water conditions in the southern Prairies, these relative proportions of species were very similar, but the numbers of northern pintail declined somewhat and the numbers of gadwall increased. However, species composition of dabbling ducks appears to have been relatively consistent over recent years.

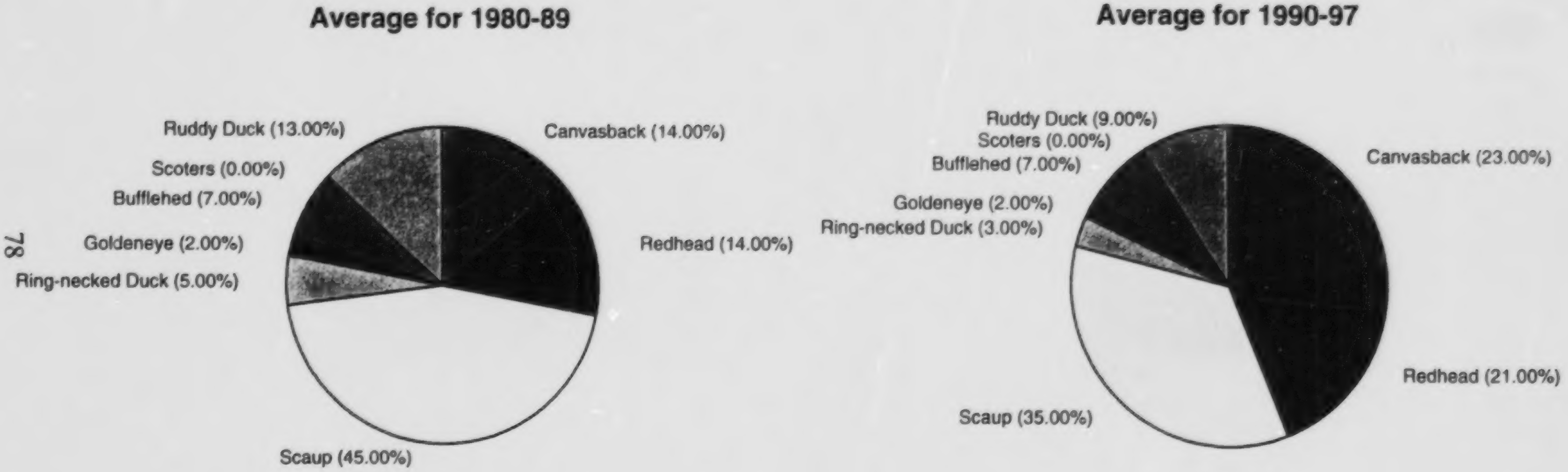
There are seven species of diving ducks which breed within the Basin (Figure 3.17). The most abundant diving duck, during the 1980-1989 period of reduced water levels in the southern Prairies, was the lesser scaup (45%). Other abundant diving ducks were the canvasback (14%), redhead (14%), and ruddy duck (13%). Bufflehead (7%), ring-necked duck (5%), and American goldeneye (2%) were relatively uncommon. During the 1990-1997 period of improving water levels in the southern Prairies, the numbers of lesser scaup declined relative to the canvasback and redhead. This decline may reflect regional declines of scaup throughout North America in recent years.

Figure 3.16
Proportion of Dabbling Duck Species in the UARB, Average 1980-89 and 1990-97



Based on USFWS/CWS Aerial Surveys

Figure 3.17
Proportion of Diving Ducks in the UARB, Average 1980-89 and 1990-97



3.3.4.2 Population Trends

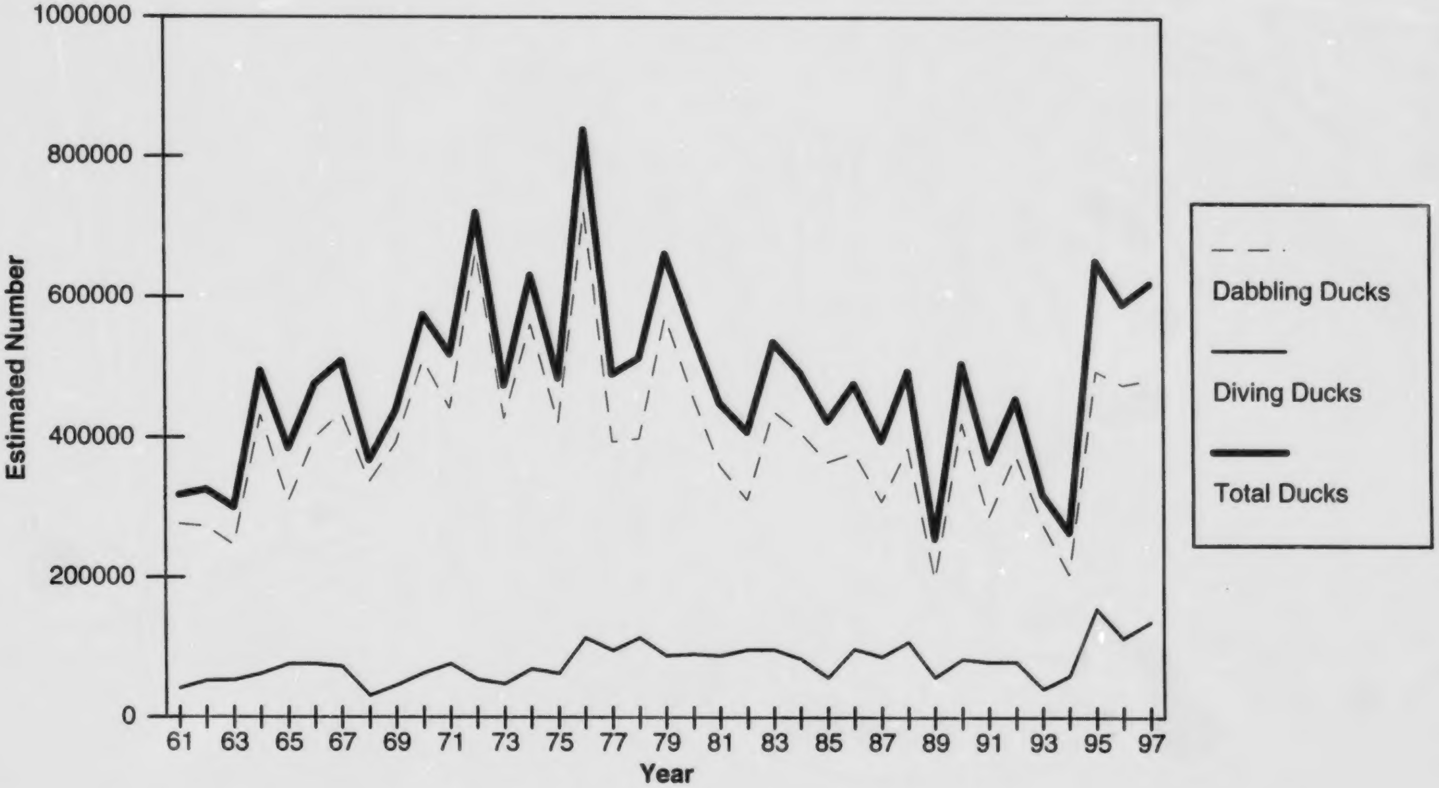
Populations of ducks within the Basin do not fluctuate in size as much as more arid regions of prairie Canada. The abundance of more permanent wetlands, and the less arid climate, allow breeding by most species in most years. However, there can still be considerable variation in numbers of breeding waterfowl among years. Water conditions in distant regions (e.g., North Dakota) can also affect duck populations within the Basin when displaced waterfowl from southern areas with drought settle in more northerly regions to breed.

Numbers of total ducks in the Basin have varied from 200,000 in the dry, late 1980s to over 800,000 in the late 1970s when water conditions were good, and continental waterfowl populations were higher (Figure 3.18). Most of these ducks were dabbling ducks and their population trends are the prime component of the trends in total duck numbers. Diving duck numbers are much lower within the Basin, and their numbers fluctuated less, between about 30,000 to 125,000.

Numbers of dabbling ducks can fluctuate considerably among years within the Basin (Figure 3.19). Mallards, the most abundant species, declined in numbers when dry conditions prevailed in the 1980s but their numbers have increased and recovered during the wet 1990s. Populations of blue-winged teal, the second most abundant species, showed a similar pattern of decrease and then an increase during these time periods. The northern shoveler has fluctuated less over the last 30 years and numbers have recently increased. The northern pintail was moderately abundant in the 1970s but numbers greatly declined in the dry 1980s, and continue to decline. Population declines are prevalent throughout the range of the northern pintail.

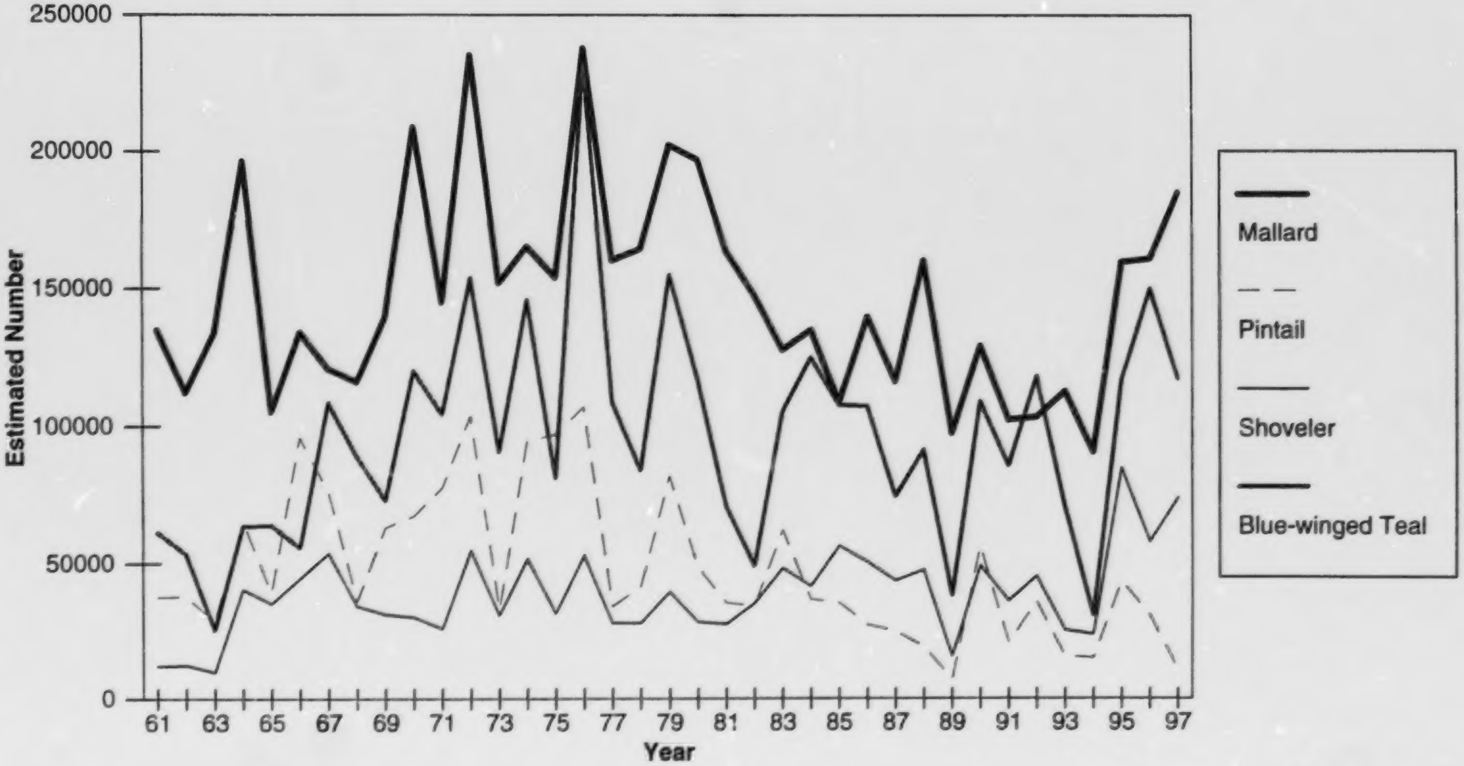
Numbers of some diving ducks do not fluctuate greatly over the years within the Basin. (Figure 3.20). The canvasback and redhead duck, which nest in more permanent wetlands with nest sites in emergent vegetation in standing water, are more stable nesting species. The lesser scaup, which nests most often near wetlands, declined in the 1980s during dry conditions, but numbers appear to be recovering within the Basin in recent years. Populations of lesser scaup are declining in more northern regions of the boreal forest.

Figure 3.18
Duck Populations in the UARB 1961-1997



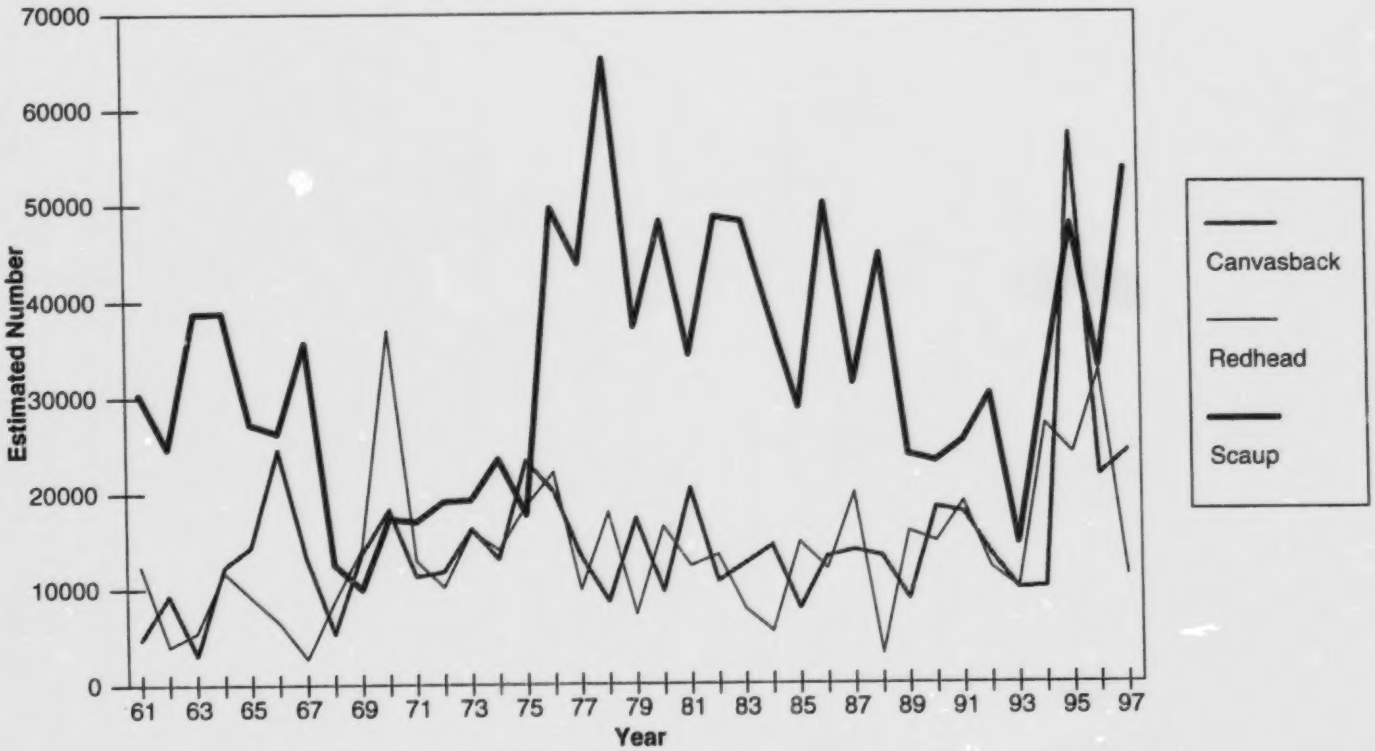
Based on USFWS/CWS Aerial Surveys

Figure 3.19
Dabbling Duck Populations in the UARB 1961-1997



Based on USFS/CWS Aerial Surveys

Figure 3.20
Diving Duck Populations in the UARB 1961-1997



Based on USFWS/CWS Aerial Surveys

3.3.4.3 Distribution of Breeding Ducks

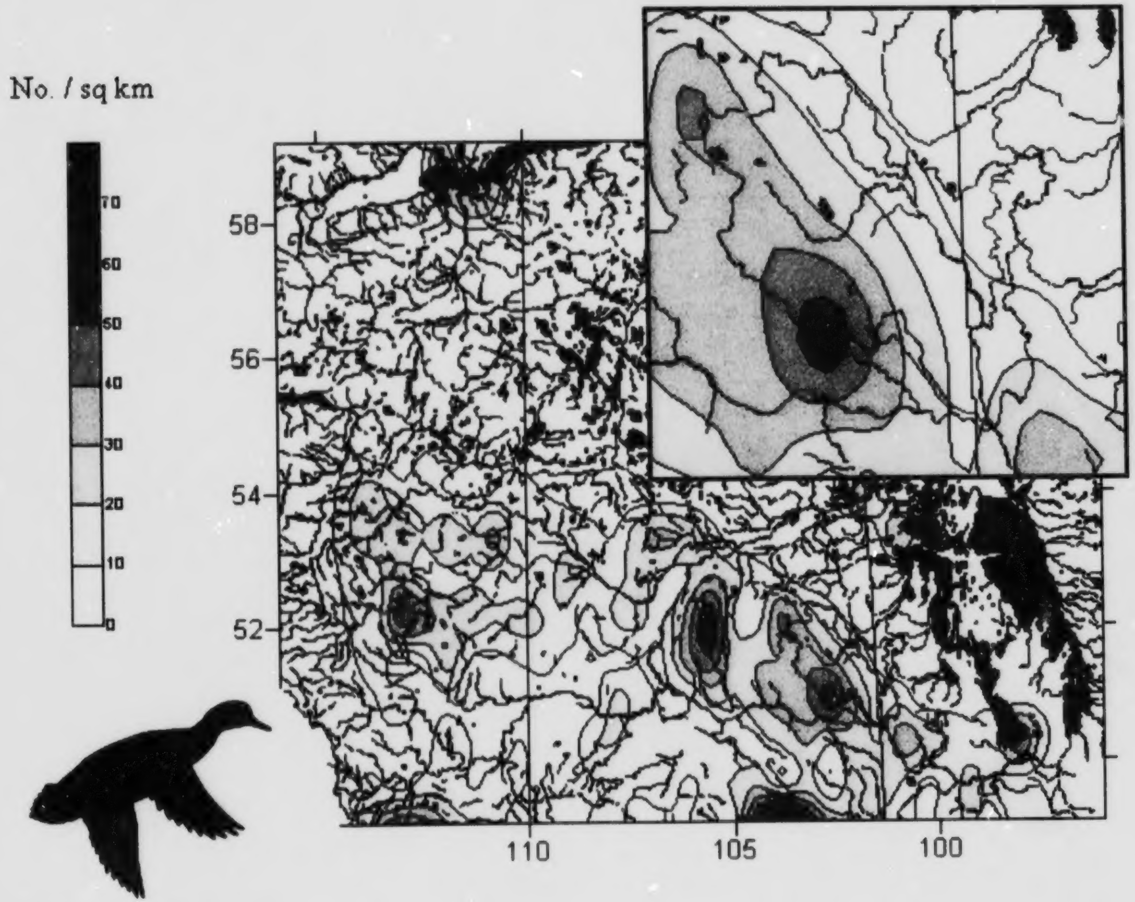
There is considerable variation in the distribution of breeding waterfowl in prairie Canada. Specific areas, where rolling morainal surficial deposits contain numerous wetlands, are often important breeding areas for waterfowl. These types of areas in the aspen parkland region, where moisture deficits are less frequent, are of particular importance. The Basin provides important breeding habitat for waterfowl within this aspen parkland region.

The Basin is an important breeding area for prairie dabbling ducks (e.g., 1995 was a year of good water conditions and high duck numbers Figure 3.21). Dabbling duck densities were high throughout the western third of the Basin, particularly in the region south of Yorkton. Figure 3.22 illustrates the distribution of the blue-winged teal in prairie Canada. This species is one of the more abundant species of dabbling ducks within the Basin, and the western portion of the Basin, particularly the region south of Yorkton, supports large numbers.

The Basin supports high numbers of diving ducks in the extreme western portion of the Basin, near Fishing Lake, and in the extreme eastern portion of the Basin, southeast of Riding Mountain National Park (Figure 3.23). Figure 3.24 illustrates the distribution of the canvasback in prairie Canada. This species is one of the more abundant species of diving ducks within the Basin. The southwest corner of the Basin west and south of Yorkton, and the eastern fringe of the Basin in Manitoba, are important regional breeding areas for this species.

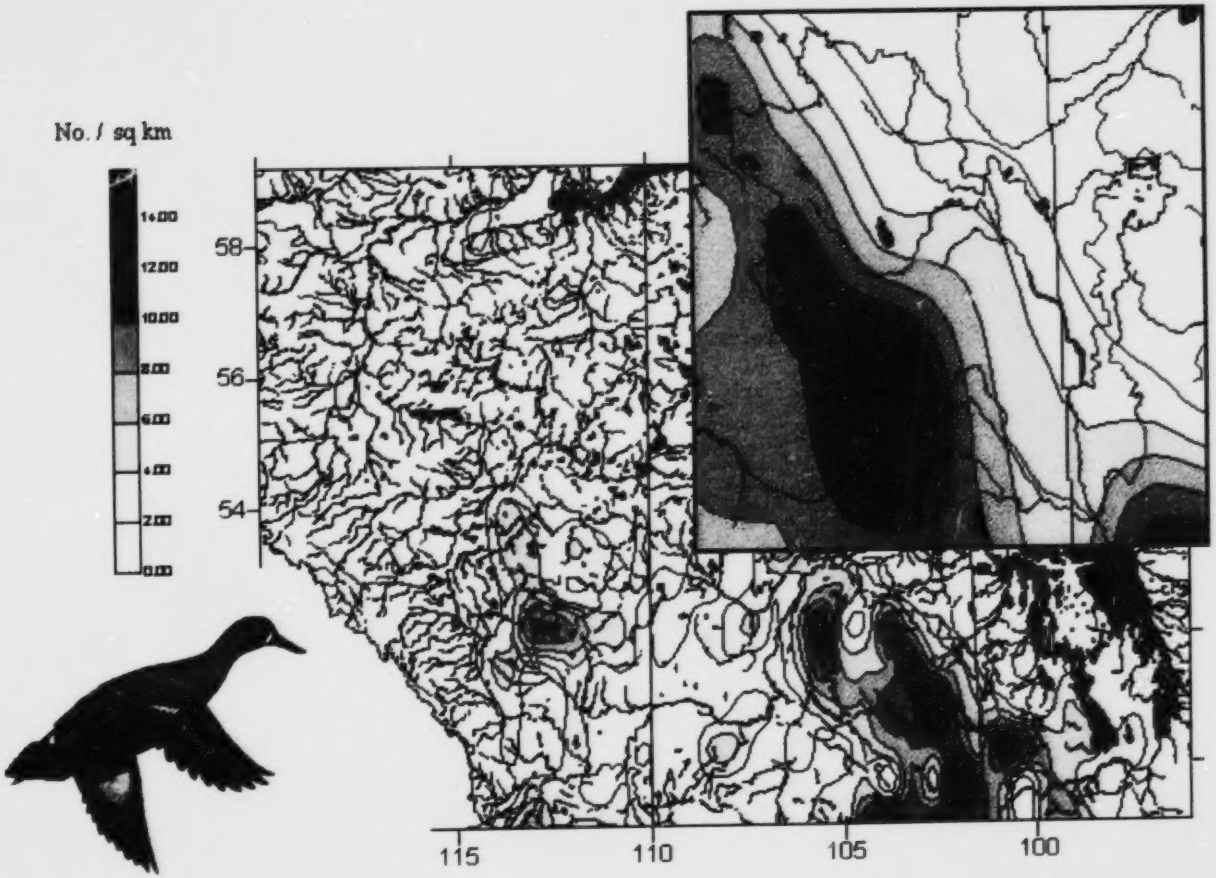
The distribution of ducks can vary throughout prairie Canada, and within the Basin, in response to water conditions. In the 1970s, good water conditions and high continental duck populations were reflected in numerous concentration areas of breeding of the mallard in the aspen parkland region (Figure 3.25). The region south of Good Spirit Lake supported large numbers of breeding mallard. In the 1980s, during a period of reduced water levels and lower continental duck populations, mallard population densities were reduced throughout the aspen parkland region (Figure 3.26). Within the Basin, numbers were also somewhat reduced but it continued to be an important breeding area. The higher density breeding area had shifted to the west and northwest of Good Spirit Lake. In the 1990s, with recovering continental waterfowl populations and improved water conditions, mallard numbers had not recovered fully by 1995 (Figure 3.27).

Figure 3.21
Dabbling Duck Density 1995



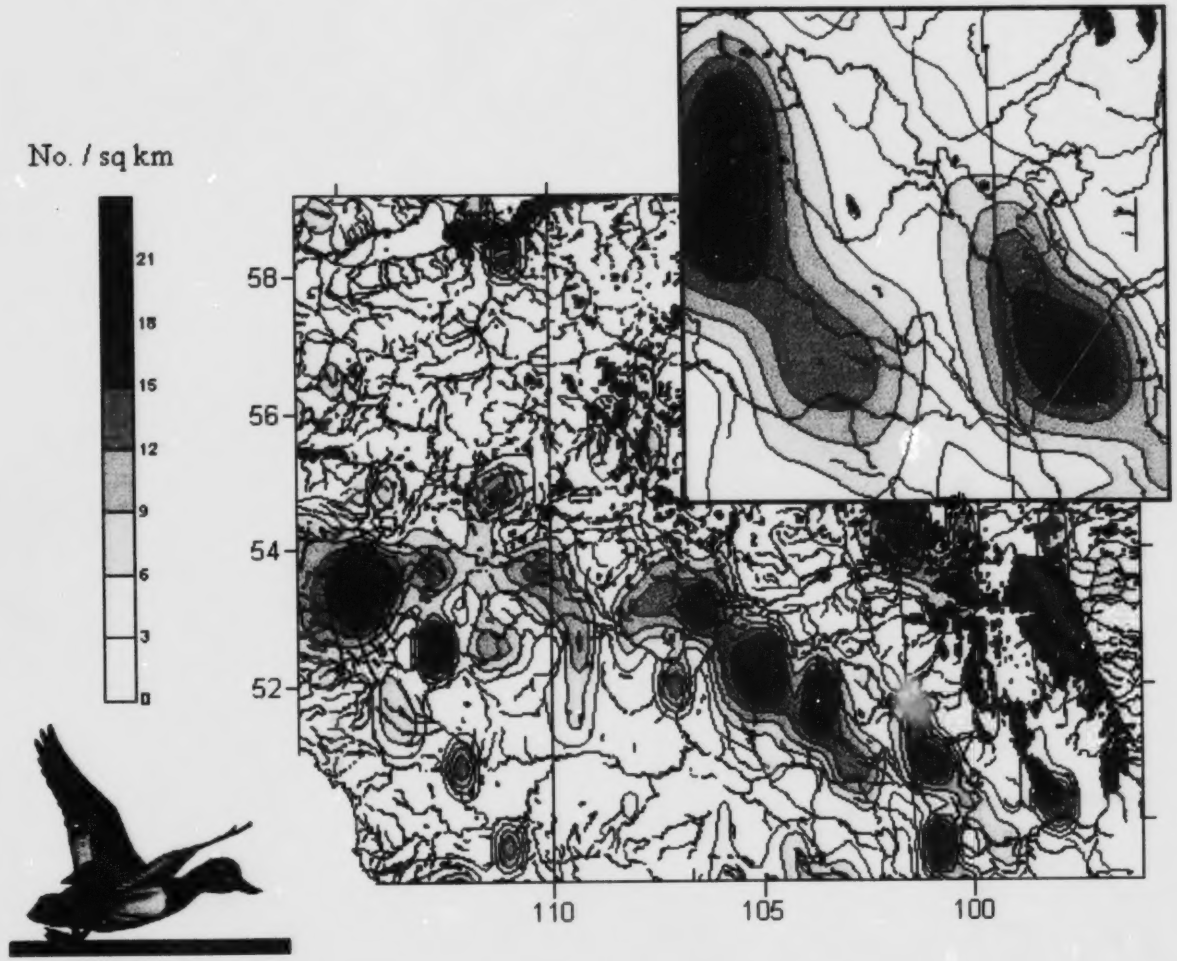
Based on USFWS/CWS Aerial Surveys

Figure 3.22
Blue Winged Teal Density 1995



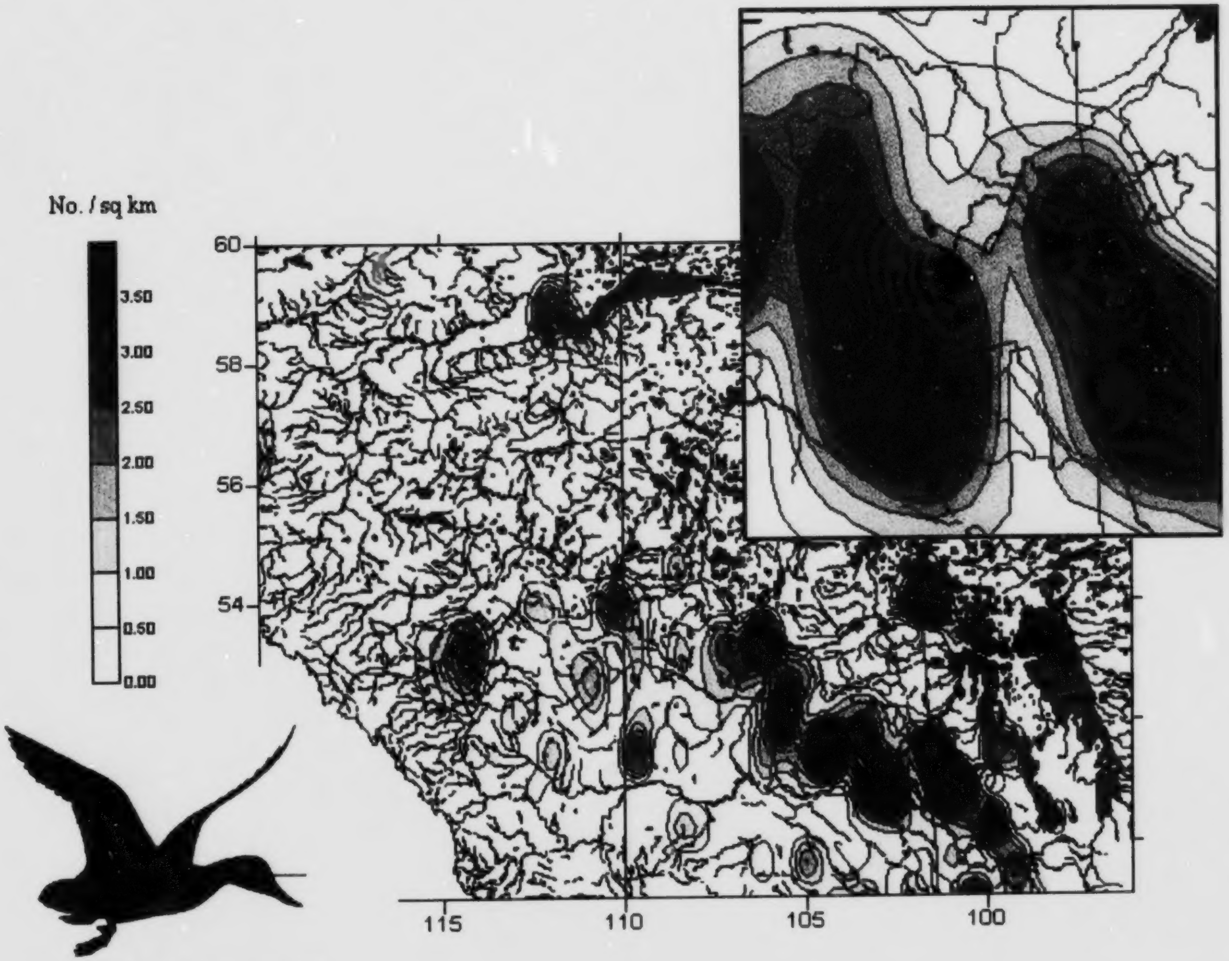
Based on USFWS/CWS Aerial Surveys

Figure 3.23
Diving Duck Density 1995



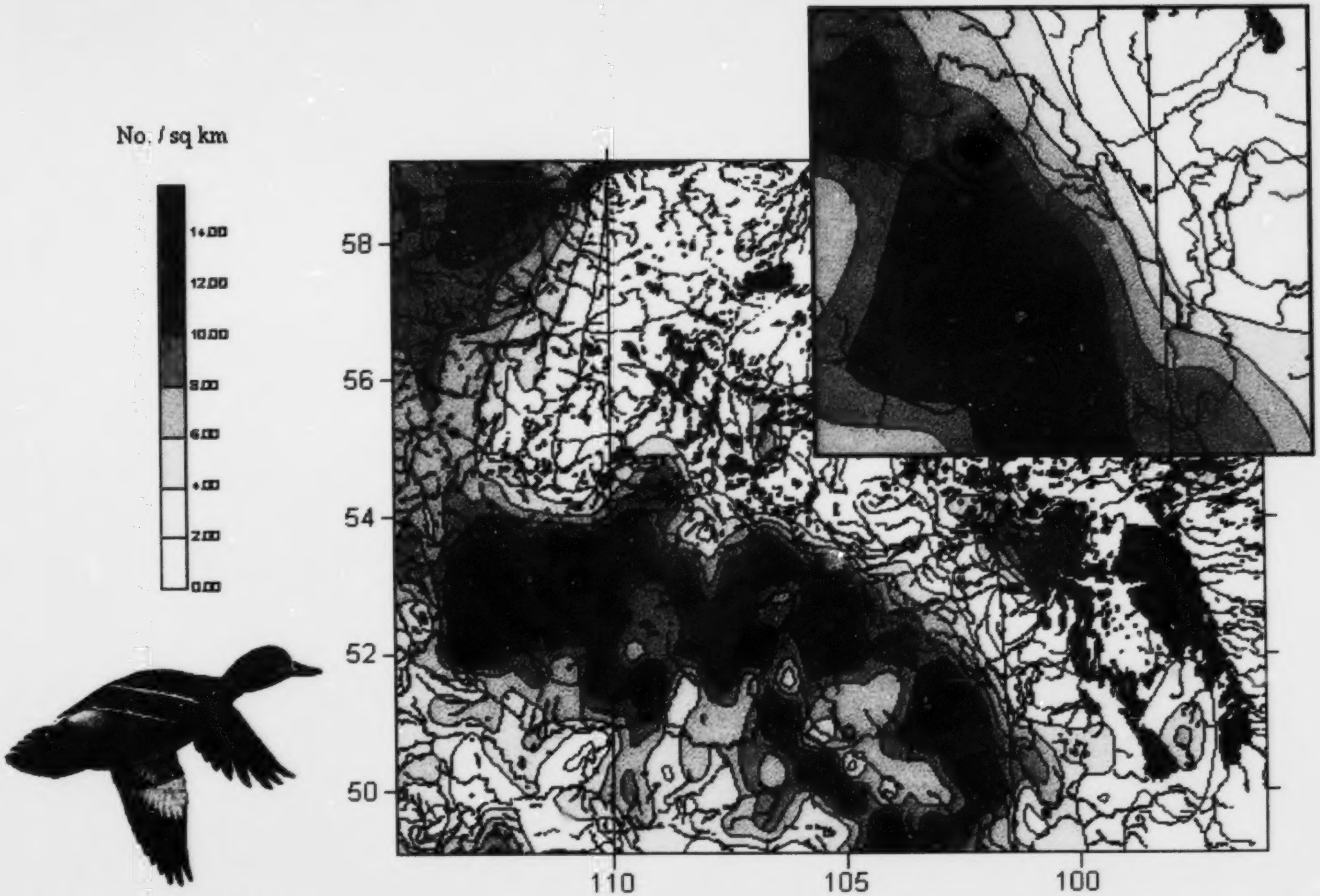
Based on USFWS/CWS Aerial Survyes

Figure 3.24
Canvasback Density 1995



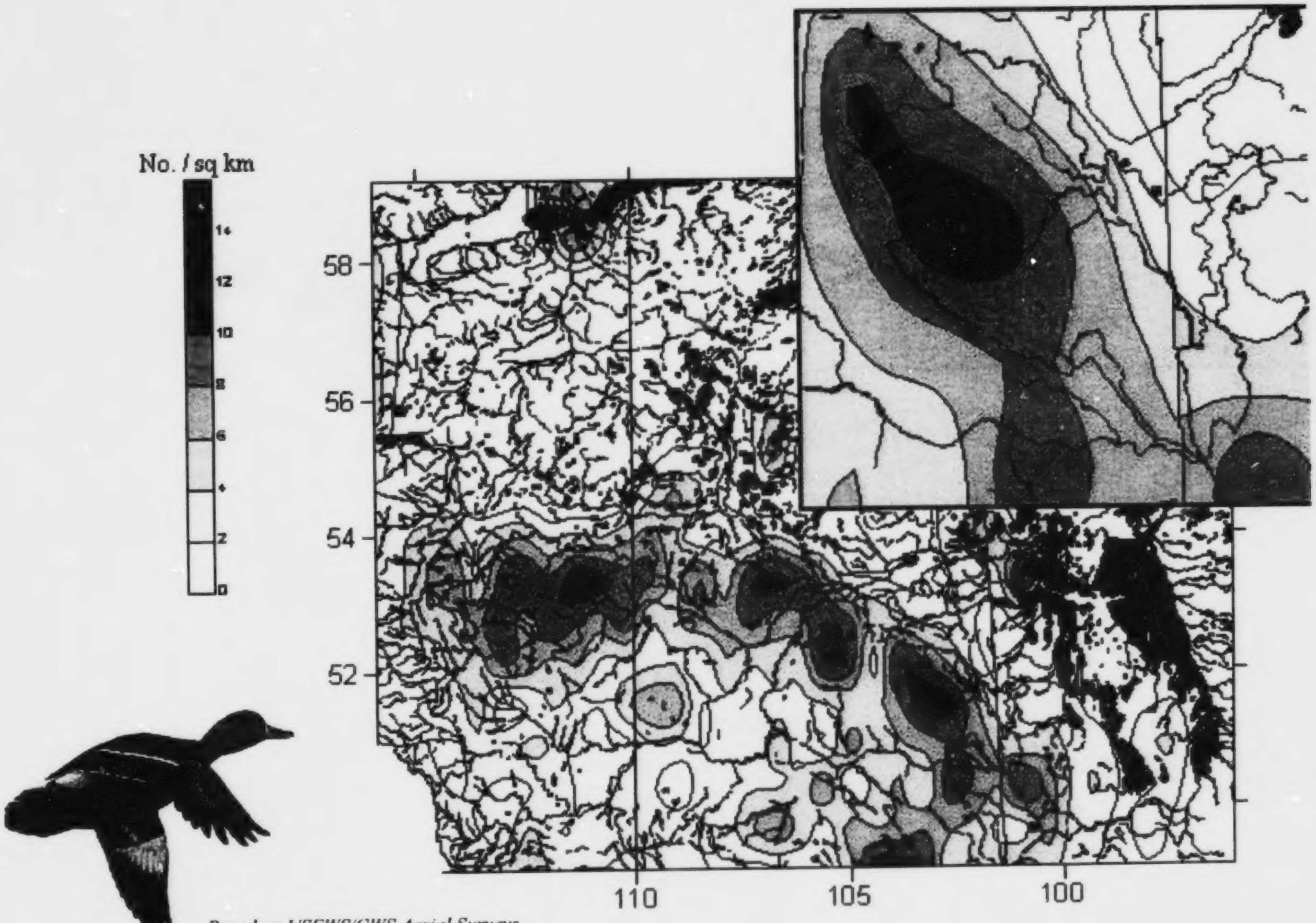
Based on USFWS/CWS Aerial Surveys

Figure 3.25
Mallard Density 1970-79



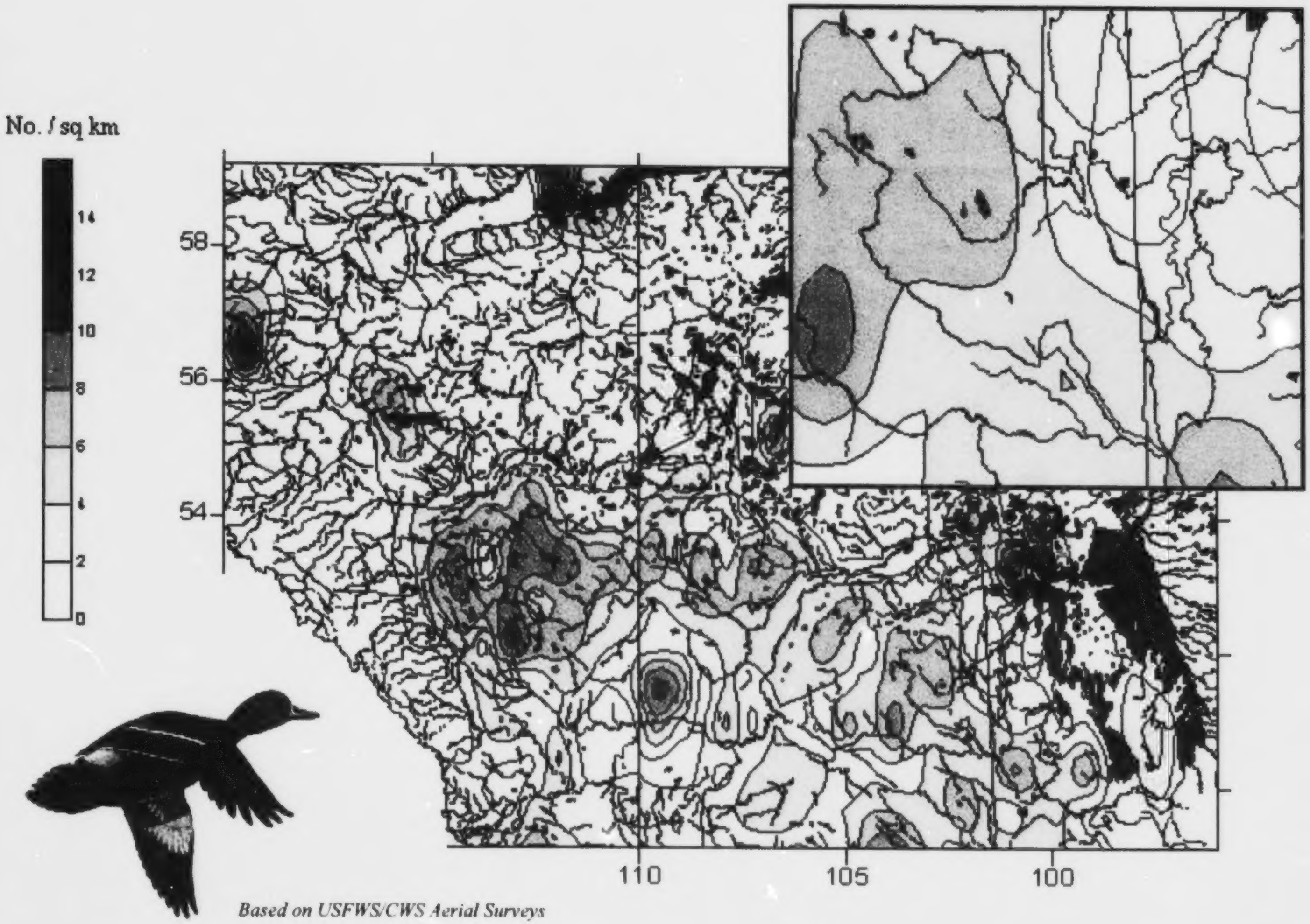
Based on USFWS/CWS Aerial Surveys

Figure 3.26
Mallard Density 1980-89



Based on USFWS/CWS Aerial Surveys

Figure 3.27
Mallard Density 1990-95



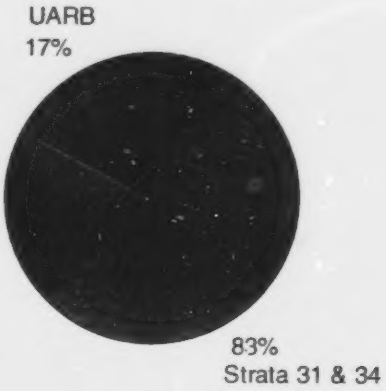
Based on USFWS/CWS Aerial Surveys

3.3.4.4 Regional Importance of the Basin for Waterfowl

The above examples of the distribution of some species of waterfowl in prairie Canada, and within the Basin, illustrate that portions of the Basin are important concentration areas of the breeding of many species of ducks. Duck populations throughout the Basin on average comprise about 17 percent of the total duck populations of the Canadian Wildlife Service and United States Fish and Wildlife Service survey strata 31 and 34 combined (Figure 3.28). These strata extend from the Manitoba border west to Last Mountain Lake and Prince Albert, and from Nipawin south to Moosomin. The area of the Basin is approximately 22,000 km^2, or about 24 percent of the combined area of these two survey strata of approximately 91,000 km^2.

However, duck populations within the Basin fluctuate less than those throughout these survey strata (Figure 3.29), and the proportion of total ducks associated with the Basin has varied from 19 to 32 percent of the total duck population of the two survey strata.

Figure 3.28
Proportion of Total Duck Population Estimate of Strata 31 to 34
Which Were Counted in the UARB



Based on USFWS/CWS Aerial Surveys

3.3.5 North American Waterfowl Management Plan Landscapes Within and Near the Basin

Approximately one third of agricultural Saskatchewan is comprised of land with a high potential for waterfowl production. The majority of this land is found in the aspen parkland ecoregion and the Missouri Couteau landform, within the prairie ecozone. High wetland densities characterize these two regions and they normally account for 70 percent of the breeding mallards in

Saskatchewan. The North American Waterfowl Management Plan (NAWMP) delineates seven key program areas within Saskatchewan's parkland and couteau for targeting habitat programs to land with the best potential for waterfowl production. Two key program areas, Pheasant Hills and Quill Lakes-Touchwood-Beaver Hills, contain land within the Basin. Land within key program areas is further delineated into "landscape" delivery units where more intensive habitat programs (e.g., lease, purchase) are targeted. The portion of the Basin that lies in Manitoba is not designated as a key program area but still contains parcels of land which qualify for NAWMP funding. Figure 3.30 illustrates the NAWMP landscape units. Table 3.10 lists the NAWMP landscapes within the Basin.

Table 3.10 - North American Waterfowl Management Landscapes in the UARB

NAWMP Key Program Area in UARB	Province	NAWMP Landscape
Pheasant Hills	Saskatchewan	Willowbrook Yorkton Churchbridge Esterhazy
Quill Lakes-Touchwood-Beaver Hills	Saskatchewan	Beaver Hills Touchwood Conjuring Creek Salkelds
SKSO*	Saskatchewan	N/A
BRDN**	Manitoba	N/A

* SKSO represents land in Saskatchewan that is not within a target landscape but still qualifies for NAWMP program – SKSO may or may not be within a Key Program Area

** BRDN represents land in Manitoba that is not within a target landscape or within a Key Program Area but still qualifies for NAWMP program

Ducks Unlimited Canada (DU) is the main program delivery agency for the NAWMP in prairie Canada. However, many other stakeholders, both government and non-government, participate through partnerships with other NAWMP agencies, through their own NAWMP initiatives (e.g., Saskatchewan Wetland Conservation Corporation's prairie shores program) and through NAWMP funded research programs (e.g., universities, research institutes).

The continental population goal of the NAWMP is to restore waterfowl populations to the levels of the 1970s under average environmental conditions – 62 million breeding ducks supporting a fall flight of 100 million birds. To contribute to this objective, the NAWMP Prairie Habitat Joint Venture seeks an annual duck breeding population of 20.8 million birds (33% of the continental total). Saskatchewan's goal within the Joint Venture is to develop a breeding population of 10 million birds in southern Saskatchewan, including 3 million mallards and 1.8 million pintails.

The Basin is a waterfowl production region of continental importance. Its numerous small wetland complexes combined with larger staging, molting and production marshes make it a key producer of North American waterfowl. In Saskatchewan, an overall 15-year NAWMP budget of $438 million dollars was proposed to affect over 5.7 million acres. Approximately $26 million dollars are directly allocated for habitat program within the Basin. The types of wildlife habitat secured to date in the Basin by Ducks Unlimited through NAWMP funding is shown in Table 3.11.

Table 3.11 - Wildlife Habitat Secured in the UARB Through the NAWMP

Habitat Type Secured	Hectares	Acres
Small Wetland Complexes *	5,909	14,773
Planted Nesting Cover *	5,252	13,131
Preserved Existing Upland Cover *	5,559	13,898
Delayed Hay Cut Agreements **	2,600	6,500
Planned Grazing Systems **	2,000	5,000
Large Licensed Wetland Complexes ***	9,051	22,627
Total Area	30,371	77,923
Total allocated- $26million		

* projects developed through purchase or lease of land – land tenure held by DU

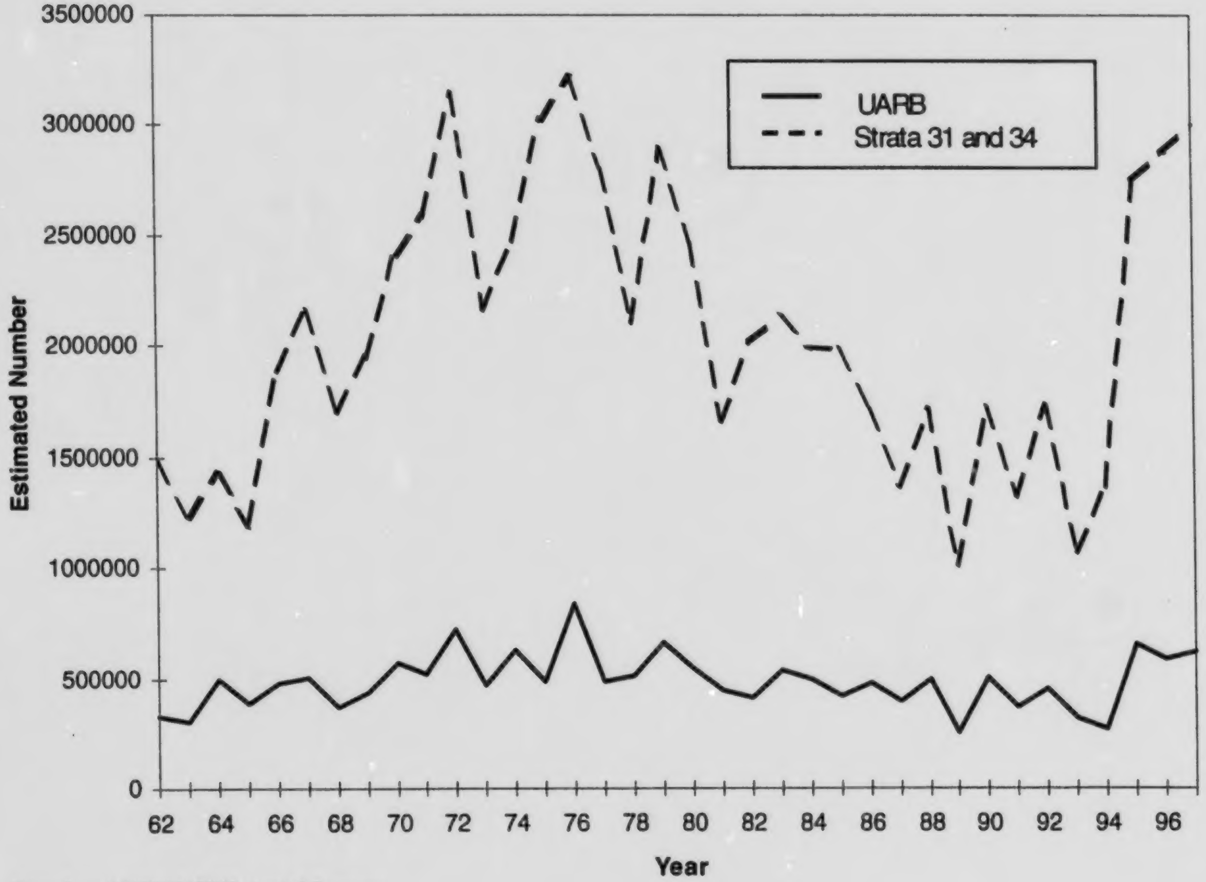
** projects developed through land management agreements between private land owner and DU

*** wetland projects developed/managed by DU through free easements with private land owners/crown consent and licensed by Sask Water/Manitoba Government

3.3.6 Waterfowl Potential

DU is developing a GIS model of potential waterfowl production based on CWS/USFWS annual breeding pair surveys, Canada Land Inventory Waterfowl Capability data and DU's wetland habitat inventory. The model illustrates the potential waterfowl breeding pair densities under average wetland conditions for five species of ducks. Figure 3.31 shows the predicted waterfowl breeding distribution in prairie Canada. Figure 3.32 shows the Basin portion of the map illustrating the potential for waterfowl production.

Figure 3.29
Duck Populations Estimates for the UARB, and Survey Strata 31 to 34 Combined Between 1962 and 1997



Based on USFWS/CWS Aerial Surveys

Figure 3.30
NAWMP Landscape Units

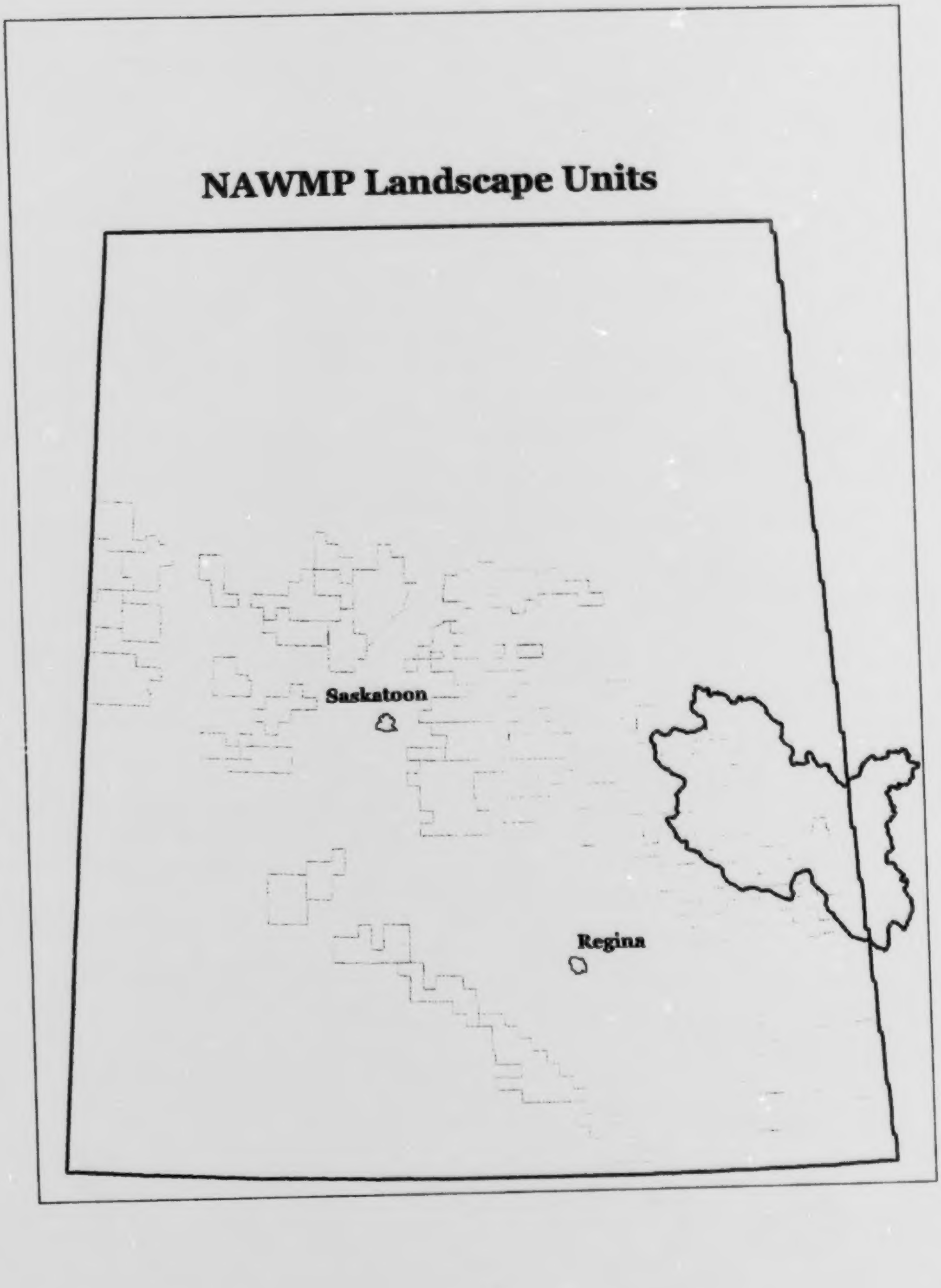


Figure 3.31
Predicted Waterfowl Breeding Distribution in Prairie Canada

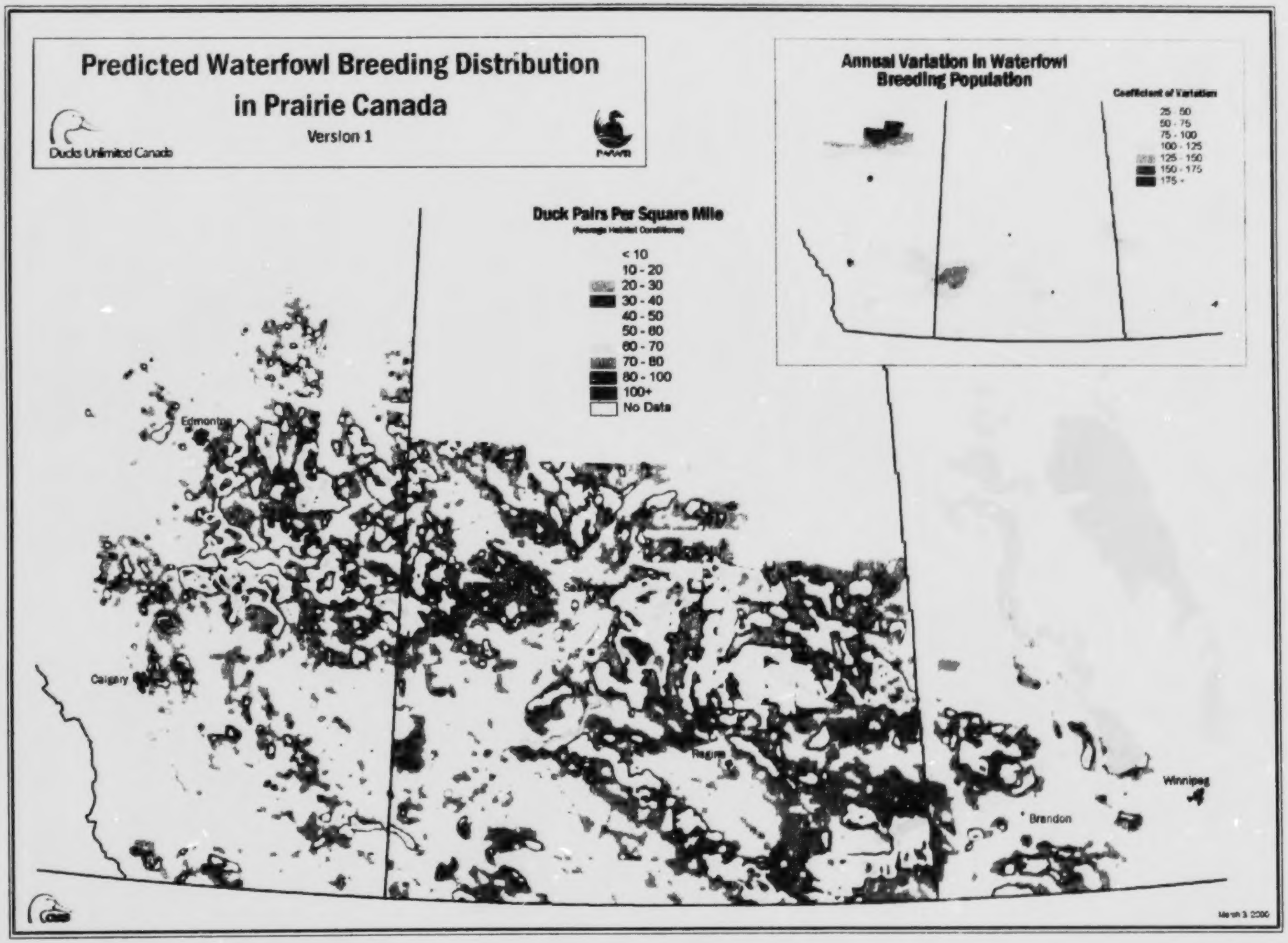
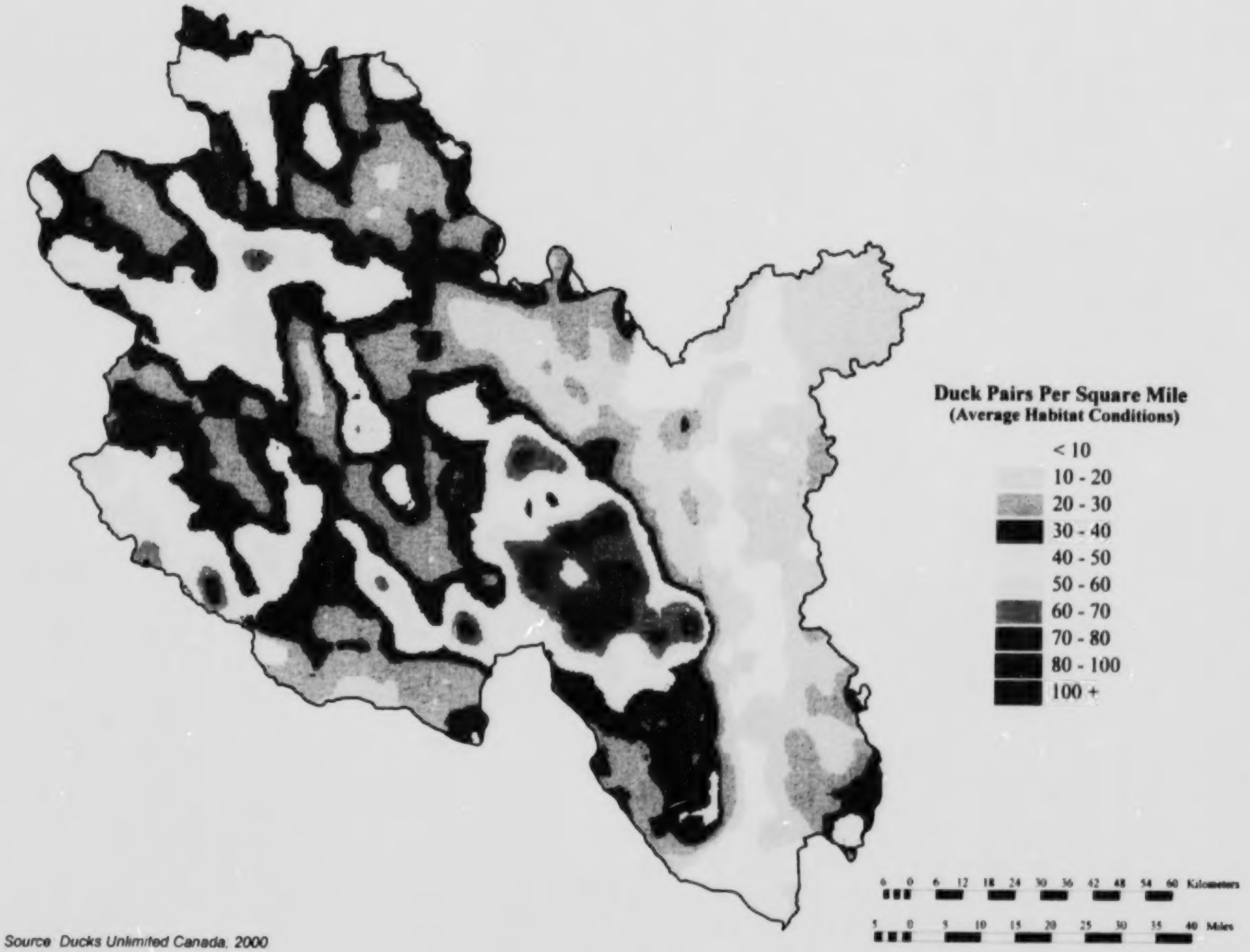


Figure 3.32
Predicted Waterfowl Breeding Distribution in the UARB


Duck Pairs Per Square Mile
(Average Habitat Conditions)
< 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 100
100 +
6 0 6 12 18 24 30 36 42 48 54 60 Kilometers
5 0 5 10 15 20 25 30 35 40 Miles

Source: Ducks Unlimited Canada, 2000

Preliminary results show that significant portions of the Basin can support potential breeding pair densities from 40 to 100 pairs per square mile (for five species combined) under average wetland conditions. Nevertheless, a constant degradation of both wetland and upland habitat are believed to severely impede the waterfowl production capability of the Basin. DU believes that habitat loss and degradation are responsible for the overall poor recruitment response of waterfowl in the Canadian prairie pothole region, relative to the United States pothole region, during the recent years of very wet conditions. The suspected reason for high recruitment in the USA is believed to be the combination of excellent wetland conditions and significant increases in perennial cover (upland nesting habitat) resulting from the US Department of Agriculture's Conservation Reserve Program.

3.4 Natural Fluctuations in Habitat

3.4.1 Wetland Dynamics

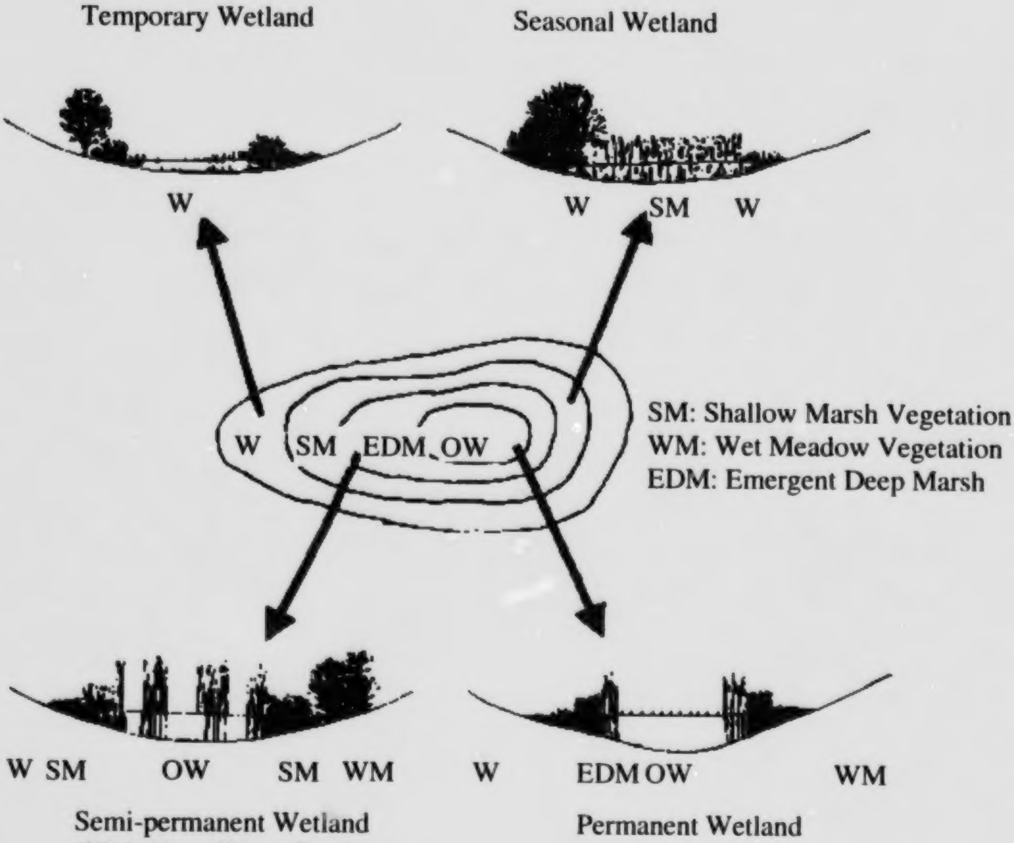
Wetlands may have one or more zones of vegetation depending on the depth and permanency of water. Temporary wetlands consist of a wet meadow vegetation zone. Seasonal wetlands have a central area of shallow marsh vegetation and often have a peripheral wet meadow zone. Semi-permanent wetlands have a central area of emergent deep marsh vegetation that borders shallow marsh and wet meadow zones on the periphery. Permanent wetlands may have temporary, wet meadow and emergent deep marsh vegetation zones. If so, a distinctive band of emergent deep marsh vegetation will be present in shallow waters on the outer edges and limited shallow marsh and wet meadow vegetation zones.

Aberrant patterns of zonation may result from periods of adjustment as vegetation adjusts to changes in environmental conditions (Kantrud *et al.* 1989a). The number of zones present is dependent on the length of time that surface water is present (i.e., moisture regime). Each zone is dominated by different plant species assemblages that are indicative of each moisture regime (see Figure 3.33). These zones are dynamic in nature, often changing dramatically throughout the course of a season due to wet/dry water cycles that are ultimately the result of climatic variability.

Changes in vegetation zonation due to changes in water permanence result in equally dynamic changes in wildlife use. There is often limited overlap in wetland use by closely related species of marsh-nesting birds such as marsh wren and sedge wren, Le Conte's sparrow and Nelson's sharp-tailed sparrow, and red-winged blackbird and yellow-headed blackbird (see Figure 3.34). This reduces competition for food and nest sites.

Seasonal changes in zonation are also important. Flooded wet meadows on the edges of semi-permanent wetlands may be used by foraging muskrats in early spring, but dry and develop into into lush grassy meadows by mid-summer which are used by skunks foraging for the nests of ground-nesting songbirds, such as the Le Conte's sparrow. As wetlands dry out they become less favourable for wildlife species that require wet meadow vegetation such as sedge wren, Le Conte's sparrow, and meadow vole, and become more favourable for species that prefer drier meadows such as savannah sparrow, western meadowlark and thirteen-lined ground squirrel. Figure 3.35 illustrates how prairie rodents inhabiting wetland margins also select habitats that limits inter-specific competition for resources.

Figure 3.33
Wetland Zonation in Prairie Wetlands



Salinity has a profound effect on the composition and distribution of wetland plant species in the prairie pothole region (Kantrud *et al.* 1989b). Salinity levels are very dynamic and often vary considerably within seasons and between years, depending on climatic variability. As a general rule, salinity is at its lowest concentration in early spring because of dilution from spring runoff. Years with little runoff, however, can result in saline conditions early in the year. Salts usually become more concentrated as water levels decrease through the summer due to plant transpiration and evaporation, particularly in smaller wetlands. Salinity may become a problem for crop production when cultivation encroaches on the wetland margins.

Figure 3.34
Use of Different Wetland Zones by Breeding Bird Species in Prairie Wetlands and Associated Uplands

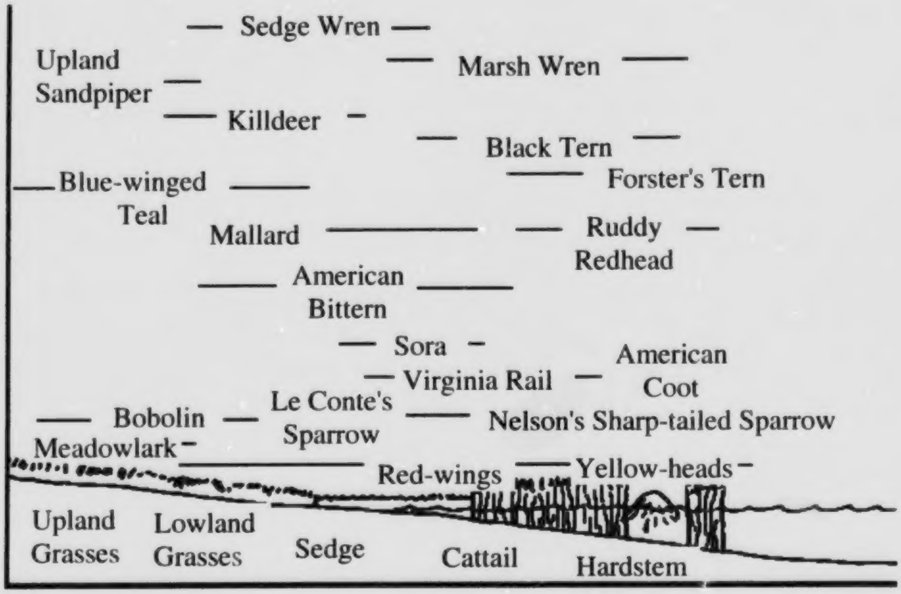
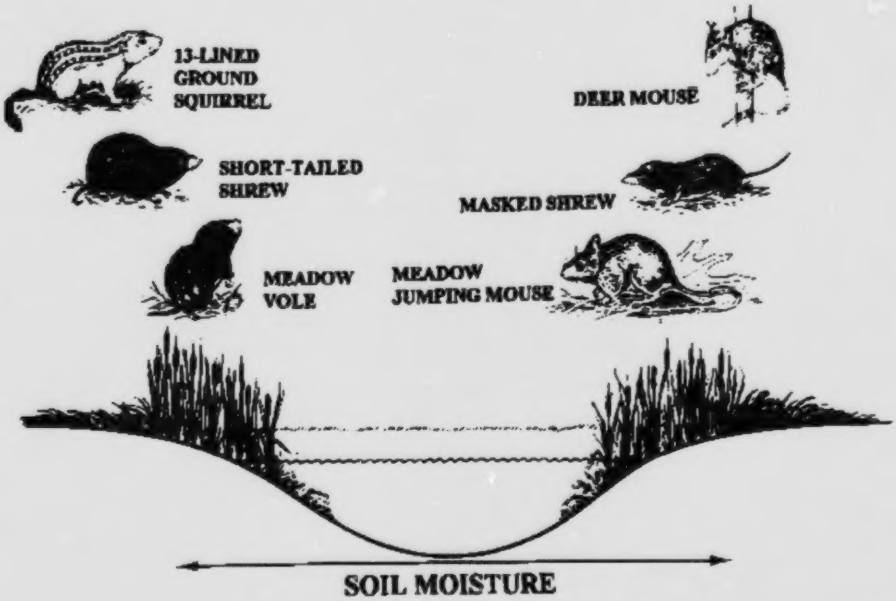


Figure 3.35
Distribution of Small Mammals in Prairie Wetlands



Salinity is an important limiting factor in plant diversity and few plant species thrive under saline conditions. Some plants have evolved the ability to seasonally adjust to changes in salt concentration, while others are more dependent on a consistent source of groundwater (Meyboom 1967). High salinity levels inhibit seed germination of some species, but others vary in their ability to germinate at different salinity levels (Galinato and van der Walk 1986). Plants specially adapted to grow in saline conditions are known as halophytes. Some halophytes commonly found in this region include ditch grass, red samphire, and western sea-blite. Saline waters do not support a wide variety of aquatic life and are not as important to most wildlife species as other wetland types. However these areas can be very productive and are often frequented by large migrating flocks of arctic-nesting shorebirds in the spring and, if water is still present, in the fall as they migrate to and from their breeding grounds. The presence of protein-rich brine shrimp in these saline waters make them more attractive for these migrating shorebirds.

3.4.1.1 Basin Wetlands

Evidence indicates that the lake marsh phase of basin wetlands resulting from stabiiized high water levels decreases biodiversity (Weller and Spatcher 1965). Therefore, wetland instability due to periodic drying and flooding results in very dynamic changes in use by wetland wildlife species. American coots and yellow-headed blackbirds in regions further south have been known to defer nesting during sub-optimal lake marsh phases until later in the season when conditions return to a more favorable condition (Weller 1994). In a northern prairie climate that has a relatively short breeding season, however, this strategy may not be effective. Semi-aquatic mammals must be mobile in response to changes in their wetland habitat. Muskrats and mink that inhabit temporary and seasonal wetlands must abandon these areas (and semi-permanent wetlands during drought years) as they dry out through the course of the warmer months and move to wetlands with deeper water that will contain the resources they need.

The use of basin wetlands by wildlife in winter contrasts dramatically with summer use. Muskrats are in their lodges in permanent and deep semi-permanent wetlands, where they use plunge holes in their lodges to gain access to the aquatic vegetation below the ice. Dense stands of emergent vegetation often used as denning sites by skunks and raccoons in winter (Mutch 1977) are important in winter survival of these species in northern latitudes (Fritzel 1989). Small mammals such as voles, mice, and shrews are still active below the surface of the snow where they attract the attention of coyotes, red foxes, and weasels.

All marsh-nesting birds migrate south for the winter months due to their dependence on open water for production of food resources. These wetlands are essentially devoid of birds for nearly half of the year. Few other birds are attracted to basin wetlands in winter. The northern shrike breeds in subarctic regions of North America and winters in southern Canada and the northern United States (Godfrey 1986). These predatory songbirds are known to frequent stands of emergent vegetation in prairie wetlands during the winter, where they prey on shrews, voles, and mice. Occasionally, when rodent populations are up, the short-eared owl may attempt to overwinter in wetlands in the Basin. Northern leopard frogs and western painted turtles spend the winter hibernating at the bottom of the deeper basins, and in lakes and rivers (Preston 1982).

3.4.1.2 Riparian Areas

Riparian ecosystems play a key role in the viability of wildlife species in the Basin, most of which utilize riparian areas at some point in their life cycle. One of the most important aspects of wildlife use of riparian zones is their role as corridors for the movement of wildlife species between habitats. Interconnected streams, creeks and rivers serve as distribution networks for wildlife species, allowing animals to move between habitats along sheltered pathways (Malanson 1993). This interchange mechanism is extremely important in the exchange of individuals between animal populations that inhabit different areas which promotes genetic exchange between populations of the same species (Malanson 1993). This is integral to the long term viability of individual animal species because it limits inbreeding within populations and allows species to continue evolutionary adaptations to their environment that are necessary for survival. These adaptations include resilience to disease and pestilence and the ability to adapt to a wide range of environmental conditions.

Another major function of connecting corridors of habitat is their role in the post-breeding dispersal of wildlife. Upon reaching maturity, the juvenile cohorts of many riparian-breeding species must leave their natal territories and seek out new habitats in which to establish territories of their own. Mink, for example, commonly inhabit creeks and rivers. Young that are born in the spring and raised in their mother's territory along a river or creek are forced to disperse in autumn (Pattie and Hoffmann 1992). Vegetated riparian corridors provide sheltered pathways for these juveniles to follow until they are able to find an unoccupied territory.

The connectivity of riparian areas allows animals that require the use of different habitats at different times of the year the ability to move between them safely. An example of this is the western painted turtle that spends most of its time basking on rocks and logs in slow-moving creeks and a variety of wetland types. During the breeding season, however, post-breeding females must seek out sandy soils in upland areas in which to bury their eggs. This often requires individuals to travel along or away from riparian habitat by way of these sheltered corridors.

Riparian habitat along streams with intermittent flow are often more sparsely vegetated than those with permanently flowing water. These corridors often connect areas that contain more suitable wildlife habitat. Therefore, sparsely vegetated riparian areas that seem devoid of wildlife are ecologically important to many wildlife species despite the fact that fewer species may actually dwell there for long periods of time.

The Upper Assiniboine River is unique in Saskatchewan because its headwaters form on the southern edge of the boreal forest and flows from northwest to southeast for nearly 1300 kilometres into southeastern Manitoba. This may be of importance in the migration patterns of the numerous species of neotropical songbirds that breed in the boreal forests of Saskatchewan and winter in tropical climates far to the south. Many of these warblers, vireos, thrushes and flycatchers appear to migrate into these forested regions of Saskatchewan from the southeast in the spring. Similarly they leave in the fall in a southeast direction en route to their tropical wintering grounds, largely bypassing the expansive prairies of western North America. While studies have indicated that migratory birds navigate using some type of internal compass, there is also evidence that topographical landmarks are used (Kerlinger 1995). The Assiniboine River may be important for this reason in that following it upstream leads directly into breeding habitat for many of these species. Birds following the Assiniboine and Shell rivers from southern Manitoba during spring migration would arrive in boreal forest breeding habitat in the vicinity of the headwaters of these rivers. This may form the last leg of spring migration for many individuals of these species. In the fall, the reverse may occur with birds following the Assiniboine River valley in a southeast direction into southern Manitoba for the first leg of their southward migration. Many migrants traveling along these river corridors undoubtedly forage extensively within them in order to meet the rigorous physiological demands of migration.

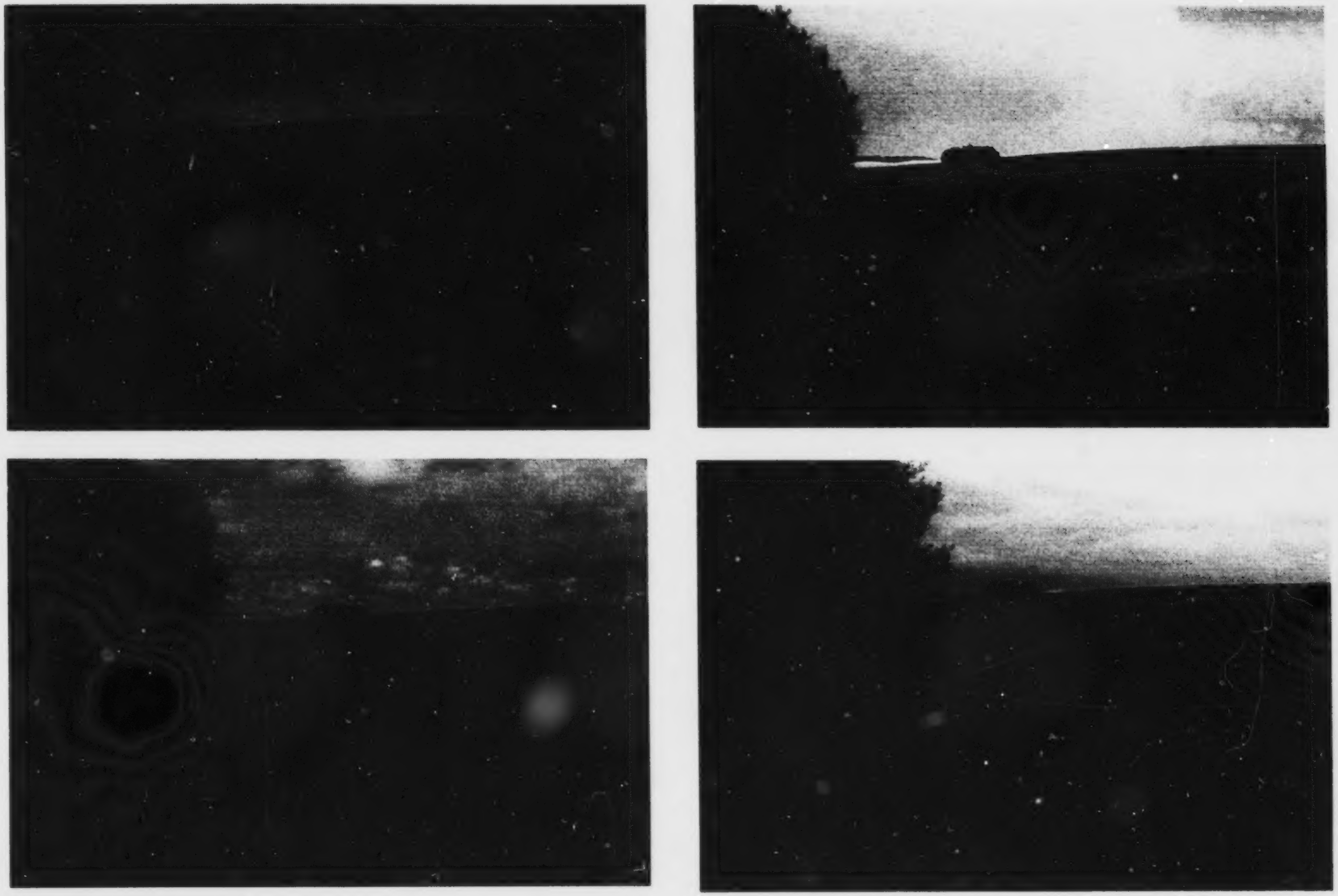
Therefore, riparian corridors are very important pathways for a wide variety of wildlife species that must move about according to seasonal requirements associated with food availability, reproduction, and dispersal mechanisms.

3.4.2 Aerial Surveys

The annual spring aerial surveys by CWS and USFWS in east central Saskatchewan and west central Manitoba and in the Basin (Figure 3.6) illustrate the dramatic fluctuation in the number of wetlands that contain water over the years. After winters of very limited spring runoff, many or all temporary and seasonal wetlands can be dry by early May. Semi-permanent and permanent wetlands may continue to hold surface water but the depth and extent of water can be significantly reduced. Vegetation can change in response to this change in water level. A wetland may change from one type to another over time depending on the available moisture. Figure 3.36 illustrates the change in a wetland under differing moisture conditions.

The variation in numbers of wetlands containing surface water and those dry at the time of survey in early May can be considerable among years. The CWS ground survey showed that this variation is also expressed among the different areas despite their relative proximity. At Yorkton wetlands with surface water were more abundant in the early 1980s, dry ponds became more frequent with increasing drought in the late 1980s, and wetland with surface water again increased in numbers thereafter as water conditions improved (Figure 3.37). At Buchanan dry ponds were most abundant except during the early 1980s and late 1990s when water conditions improved (Figure 3.38). At Penrith, which is characterized by a large number of temporary wetlands, the proportion of wetlands with or without surface water fluctuated greatly (Figure 3.39). Differences in spring run-off among areas can greatly affect the proportion of wetlands which retain surface water in early May, and the type of wetlands present are in turn important.

Figure 3.36
Changes in a Wetland under Differing Moisture Conditions



Canadian Wildlife Service

Figure 3.37
Number of Wetlands with some Water, or Dry, in Early May along the Yorkton Ground Transect of CWS Habitat Surveys

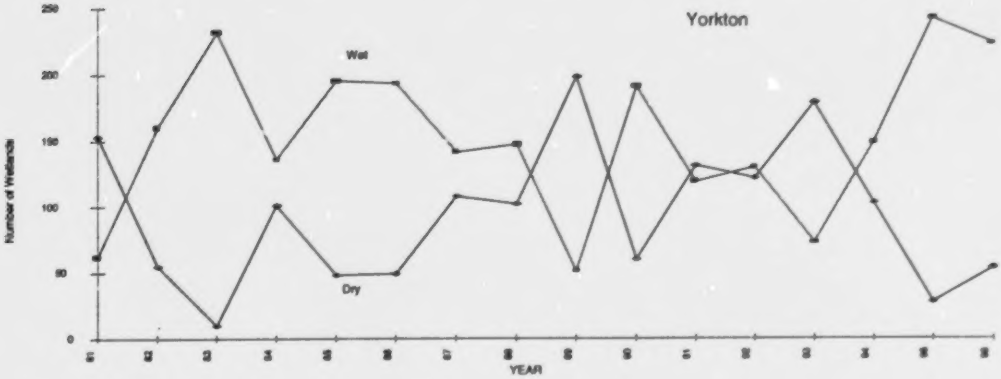


Figure 3.38
Number of Wetlands with some Water, or Dry, in Early May along the Buchanan Ground Transect of CWS Habitat Surveys

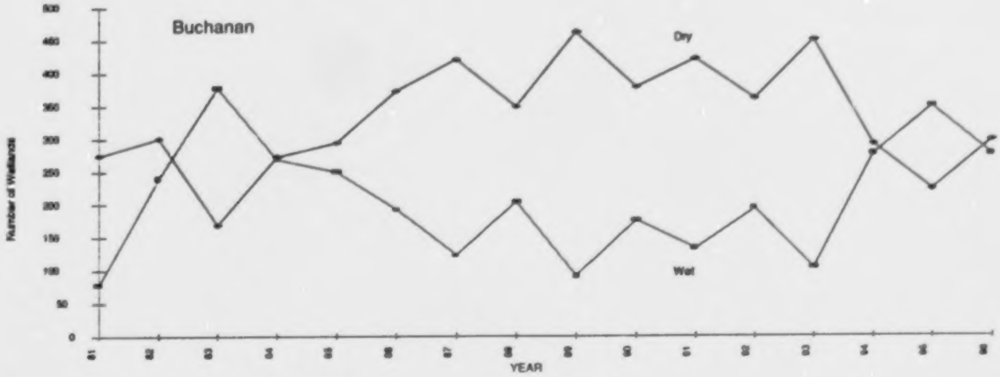
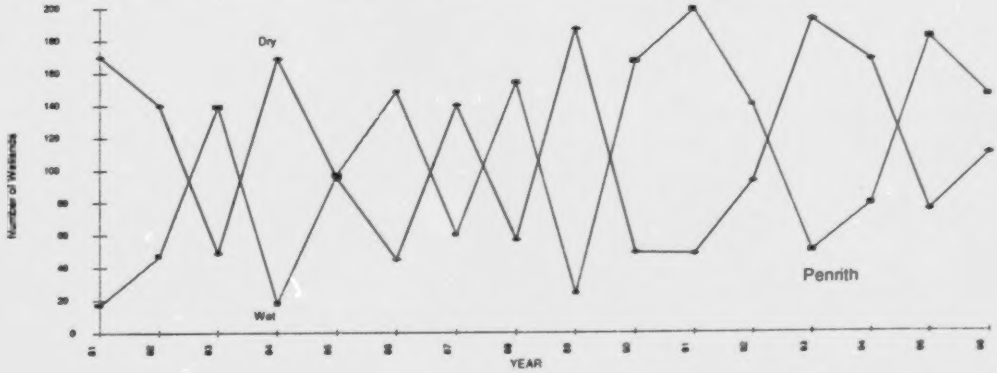


Figure 3.39
Number of Wetlands with some Wet, or Dry, in Early May along the Penrith Ground Transect of CWS Habitat Surveys



Although the basetype of a wetland represents its maximum potential, in terms of water permanency under full supply conditions, a given wetland varies in type from year to year. Temporary wetland basetypes are usually small, shallow depressions which can quickly fill with spring run-off, and as quickly become dry or not fill if spring run-off is limited. They can become seasonal wetland basetypes in years of very high spring run-off. Seasonal wetlands tend to be somewhat larger and deeper, but these also change in type quickly in response to spring run-off conditions. They may be classified as temporary wetlands or be dry in dry years, and some may be classified as semi-permanent in very wet years.

Semi-permanent and permanent wetland basetypes also can change in type in a given year in response to spring run-off conditions. However, these wetlands are larger and much deeper and changes in type usually require major changes in spring run-off supply, or prolonged periods or drought or high water conditions. The water level stage of these wetlands more often is the most obvious change in wetland character. Water levels may range from strongly recessional to over-flowing although the type for successive years does not change.

Although sample sizes are limited for permanent and semi-permanent wetland basetypes, it appears that these wetland types appear to be more frequently typed as less permanent seasonal wetlands during the 1990s when water conditions were improving. It is not clear if this represents changes to these wetlands, possibly from drainage activities, or if an insufficient period of time has elapsed for most of these wetland basetypes to recover from the drought conditions of the late 1980s.

Figures 3.40, 3.41, 3.42, and 3.43 illustrate the change in the wetlands classed as temporary, seasonal, semi-permanent and permanent along the Yorkton transect from 1981 to 1996.

Figure 3.40
Changes in Wetland Type of Temporary Basetype Wetlands along the Yorkton Transect of CWS Ground Surveys

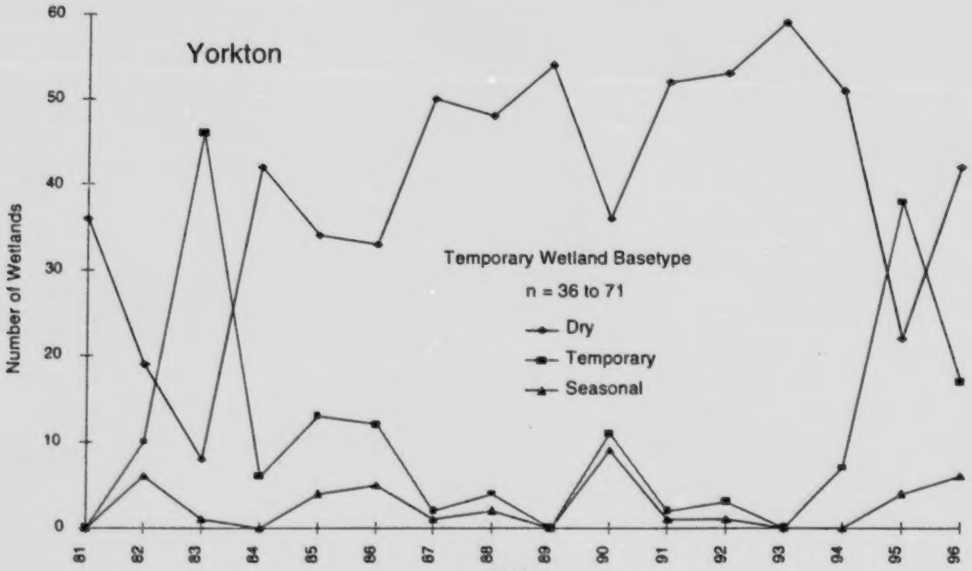


Figure 3.41
Changes in Wetland Type of Seasonal Basetype Wetlands along the Yorkton Transect of CWS Ground Surveys

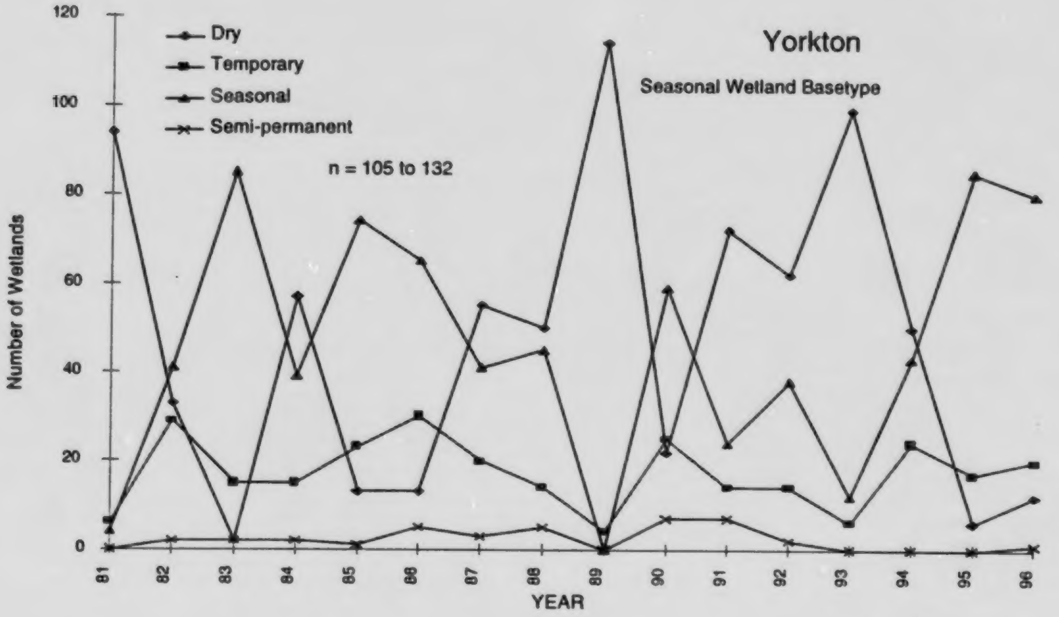


Figure 3.42
Changes in Wetland Type of Semi-Permanent Basetype Wetlands along the Yorkton Transect of CWS Ground Surveys

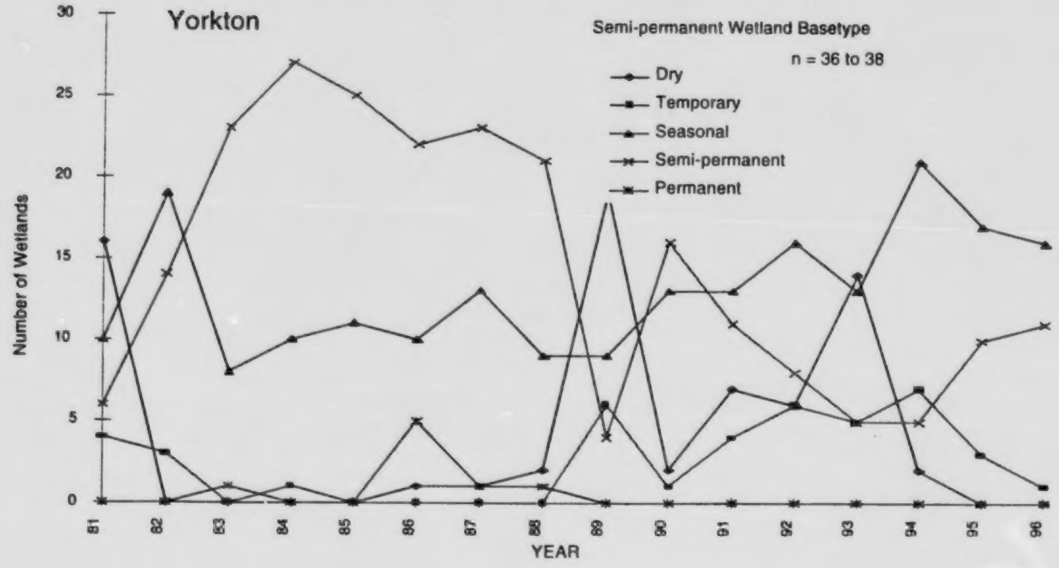
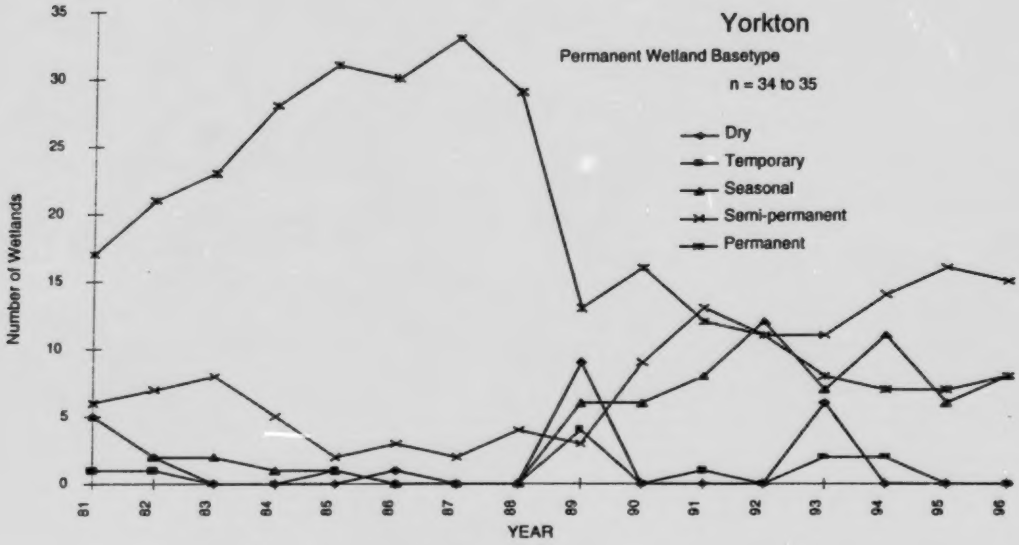


Figure 3.43
Changes in Wetland Type of Permanent Basetype Wetlands along the Yorkton Transect of CWS Ground Surveys



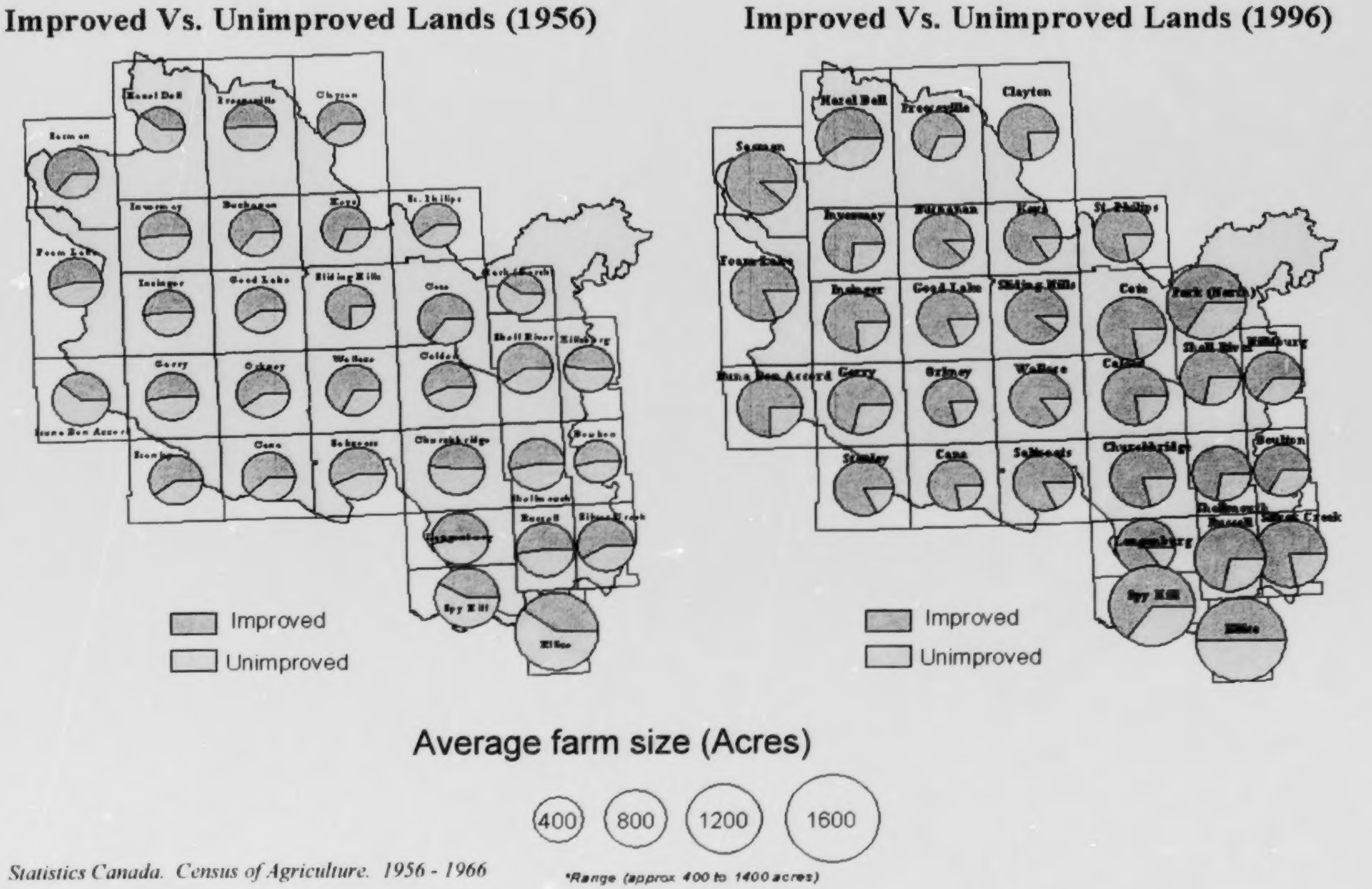
3.5 Land Use Impacts on Habitat

Development of land for municipal, industrial, agricultural and transportation uses results in changes to wetland basins, riparian vegetation along stream corridors and native upland vegetation. These changes may be temporary or permanent depending on the use of the land. This section presents information available on changes in wetlands, uplands and land use as a result of land development.

3.5.1 Agricultural Land Use Statistics

Analysis of the data collected by Statistics Canada showed the changes in the proportions of land use reported by landowners. Figure 3.44 illustrates the average farm size and the proportion of farm acreage reported as improved and unimproved in each rural municipality in the Basin in 1956 and 1996. Unimproved land includes wetland, bush, trees, pasture and natural vegetation. Improved land includes cropland, summer fallow, seeded pasture and tame hay. Between 1956 and 1996 the acreage reported as unimproved decreased from 44 percent to 24 percent. The annual crop and summer fallow acreage increased from 51 percent to 64 percent. Figures 3.45 and 3.46 illustrate the proportion of land in various uses in 1956 and 1996. Figure 3.47 illustrates the change in land use averaged for a quarter section of land between 1956 and 1996.

Figure 3.44
Agricultural Statistics Improved and Unimproved Lands 1956 and 1996



Statistics Canada. Census of Agriculture. 1956 - 1966

Figure 3.45
Agricultural Land Use Statistics1956

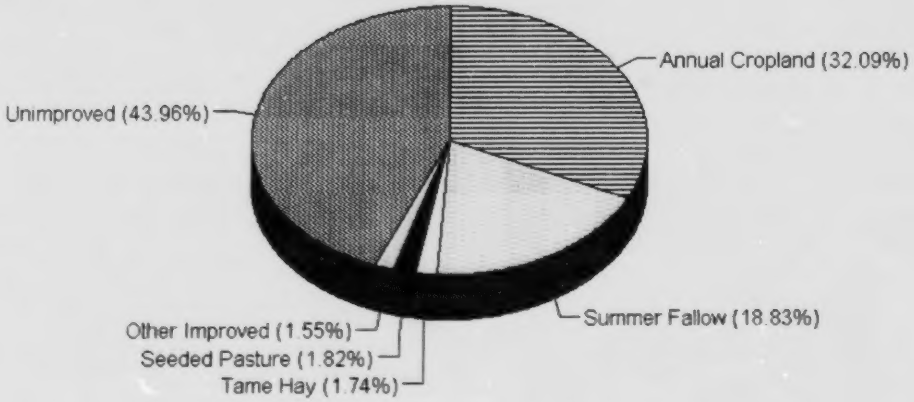
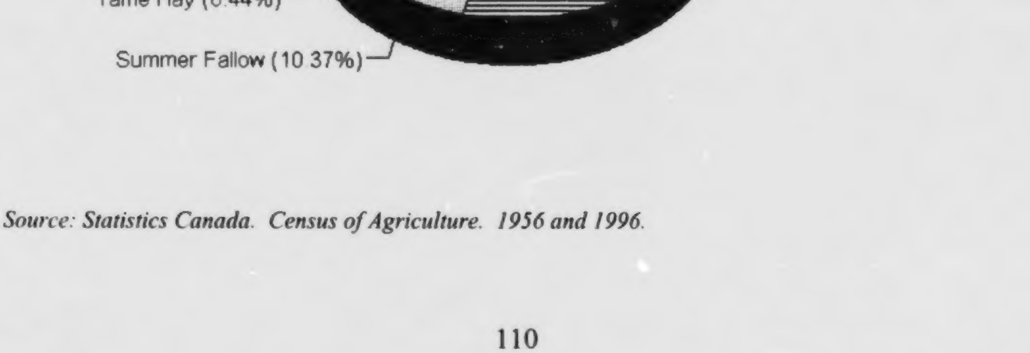
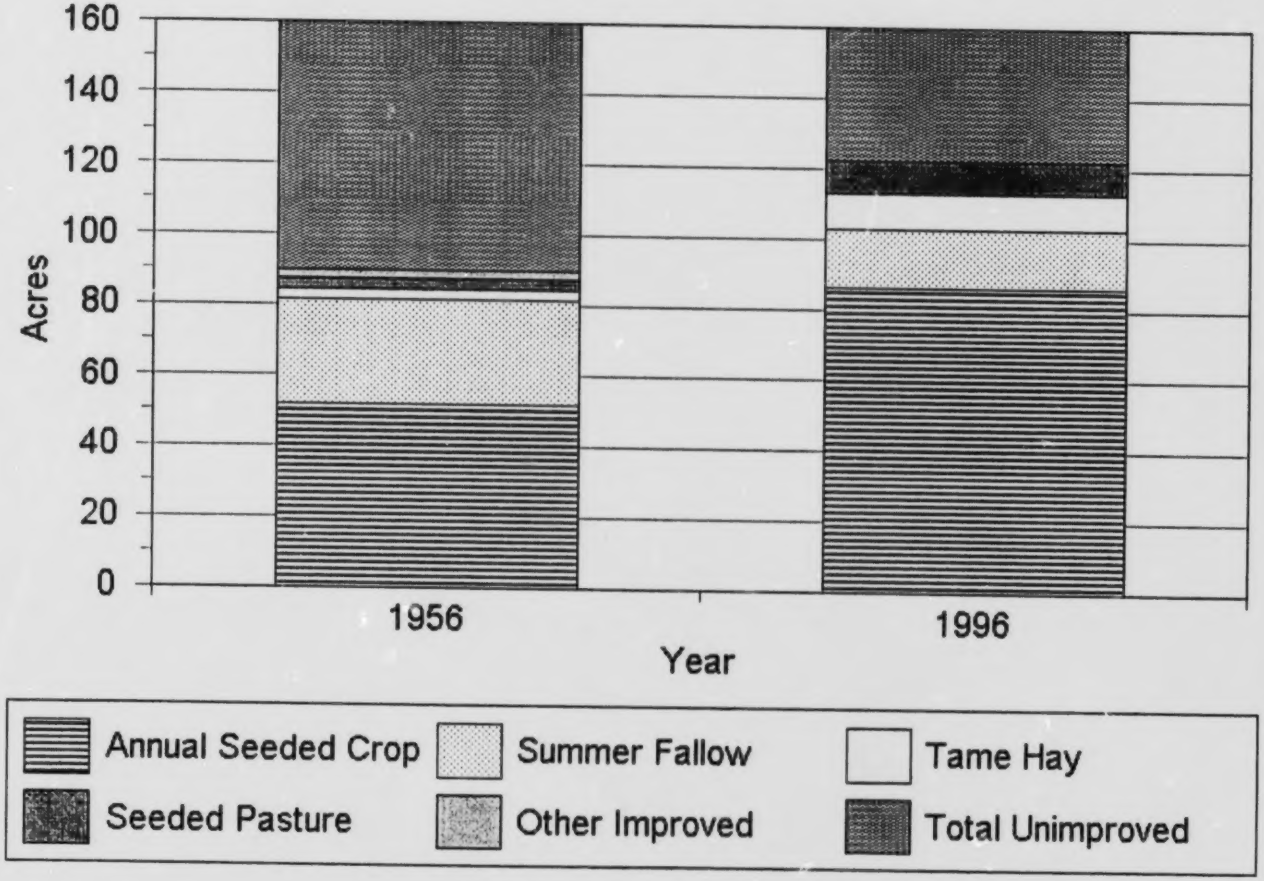


Figure 3.46
Agricultural Land Use Statistics 1996



Source: Statistics Canada. Census of Agriculture. 1956 and 1996.

Figure 3.47
Average Quarter Section Land Use 1956 and 1996



Source: Statistics Canada. Census of Agriculture. 1956-1996.

3.5.2 Aerial Photo Analysis

3.5.2.1 Yorkton Area

The aerial photo analysis of 20 sections of land in the Yorkton study area showed the following changes in the numbers of wetland acres between 1948 and 1995:

- the average decrease in wetland acres for the 20 sections of land was 45 percent;
- in eight sections there was no decrease in wetland acres; and
- in five sections, there was 100 percent decrease in wetland acres.

Figure 3.48 shows the study area. Figure 3.49 shows a randomly selected section of land in this study as photographed in 1949 and 1995. The change in the number of acres in wetlands can be seen by comparing these aerial photos.

3.5.2.2 Langenburg Area

An aerial photo interpretation of land use change in the proposed Langenburg East Flood Control Project showed a decrease in the areas of land in sloughs from 1957 to 1989 of 58 percent. Table 3.12 provides the results of this study.

Table 3.12 - Langenburg East Flood Control Project Land Use 1957 and 1989

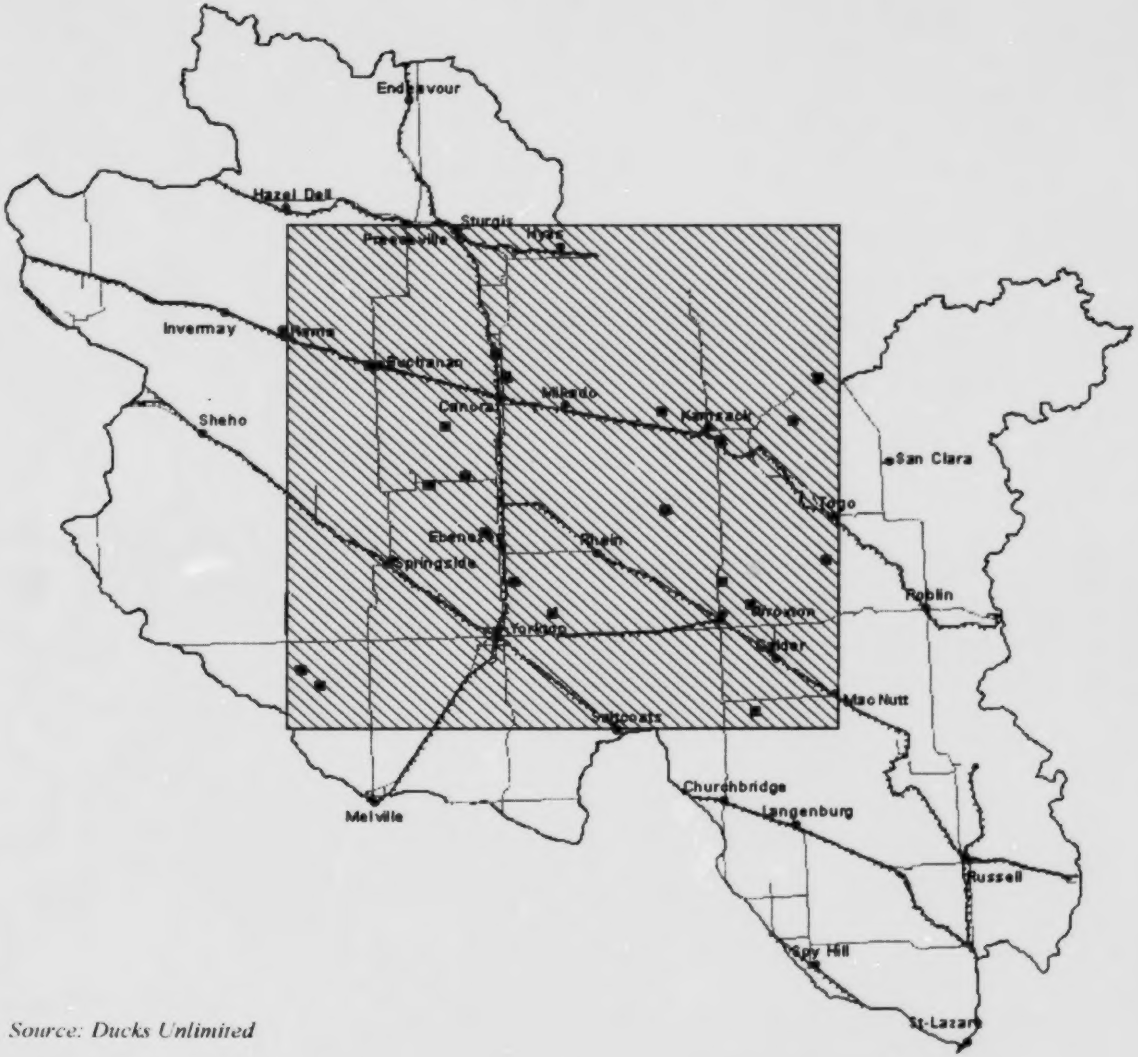
Land Use Type	Area 1957		Area 1989		Percentage Change
	acres	hectares	acres	hectares	
Slough	2,959 (16%)	1,184	1,257 (7%)	503	-58%
Bush	1,972 (11%)	789	1,083 (6%)	433	-45%
Uncultivated	5,795 (31%)	2,318	1,445 (8%)	578	-75%
Cultivated	7,751 (42%)	3,100	14,669 (79%)	5,868	89%
Miscellaneous	101 (<1%)	40	124 (<1%)	49	<1%
Total Area	18,578	7,431	18,578	7,431	

Based on 1957 and 1989 aerial photos

3.5.2.3 Township Study

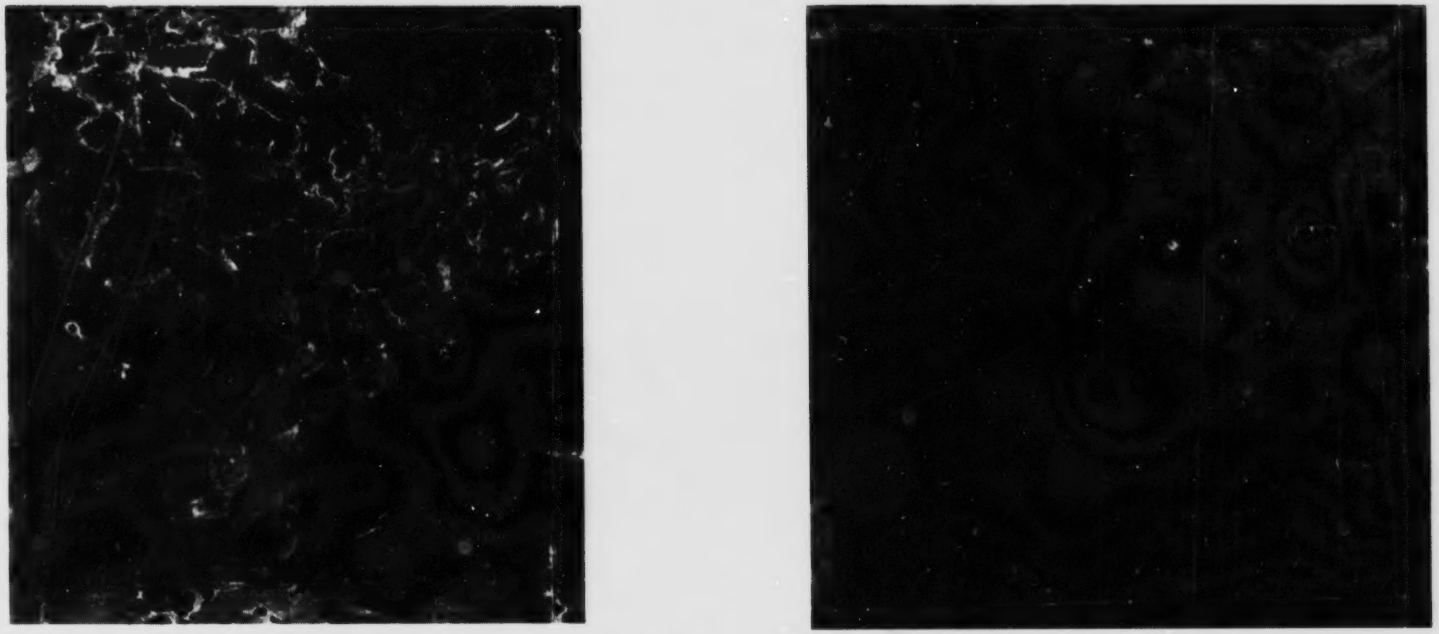
For the four townships in the Buchanan study area, between 79 and 85 percent of the wetland area was impacted by drainage between 1950 and 1998. These impacts ranged from complete elimination of basins to alterations in basin hydrology. The average area affected was 81 percent. In these same sections of land, the change between 1980 and 1998 ranged from 9 to 18 percent, with an average of 13 percent of the wetlands altered. Figure 3.50 shows the study area.

Figure 3.48
Wetland Air Photo Analysis 1995



Source: Ducks Unlimited

Figure 3.49
Aerial Photo 1948 and 1995

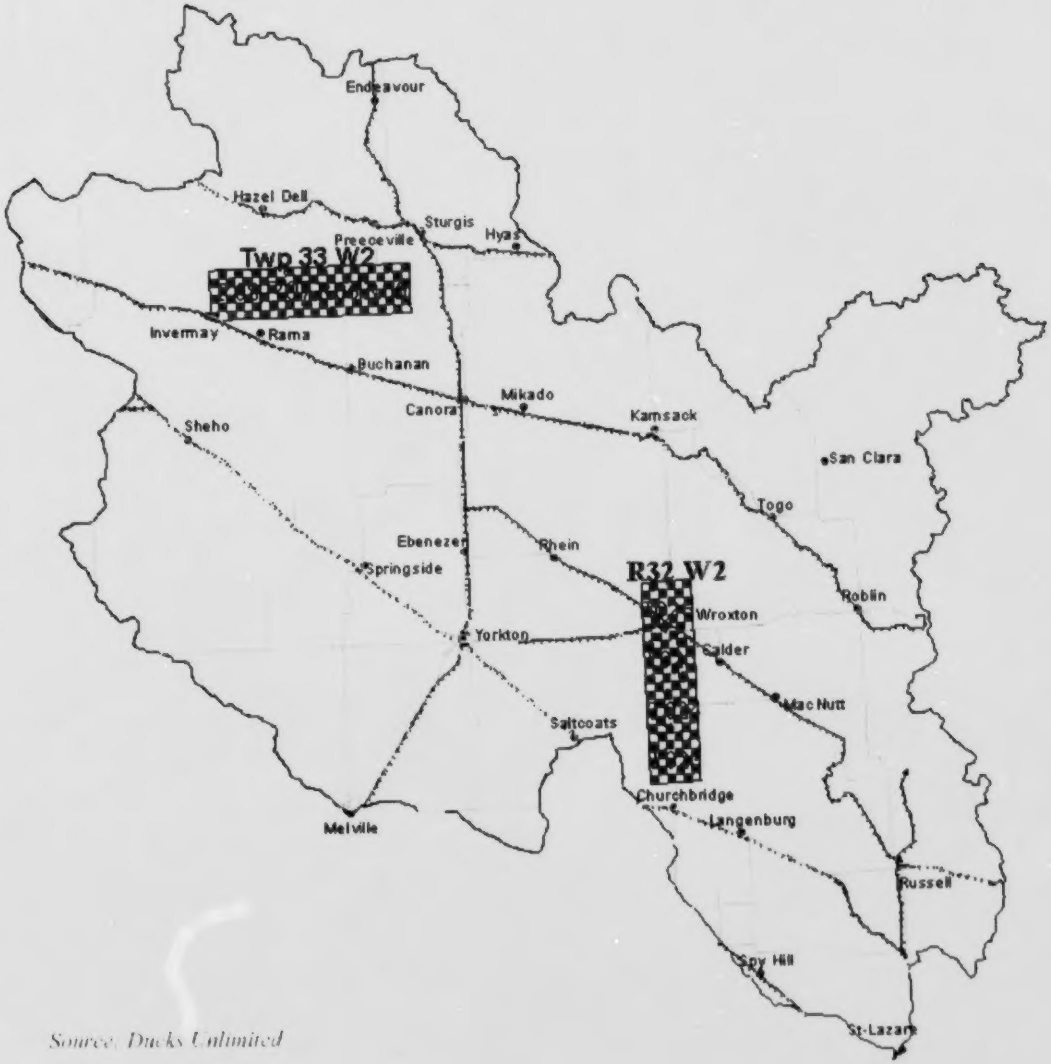


1949

1995

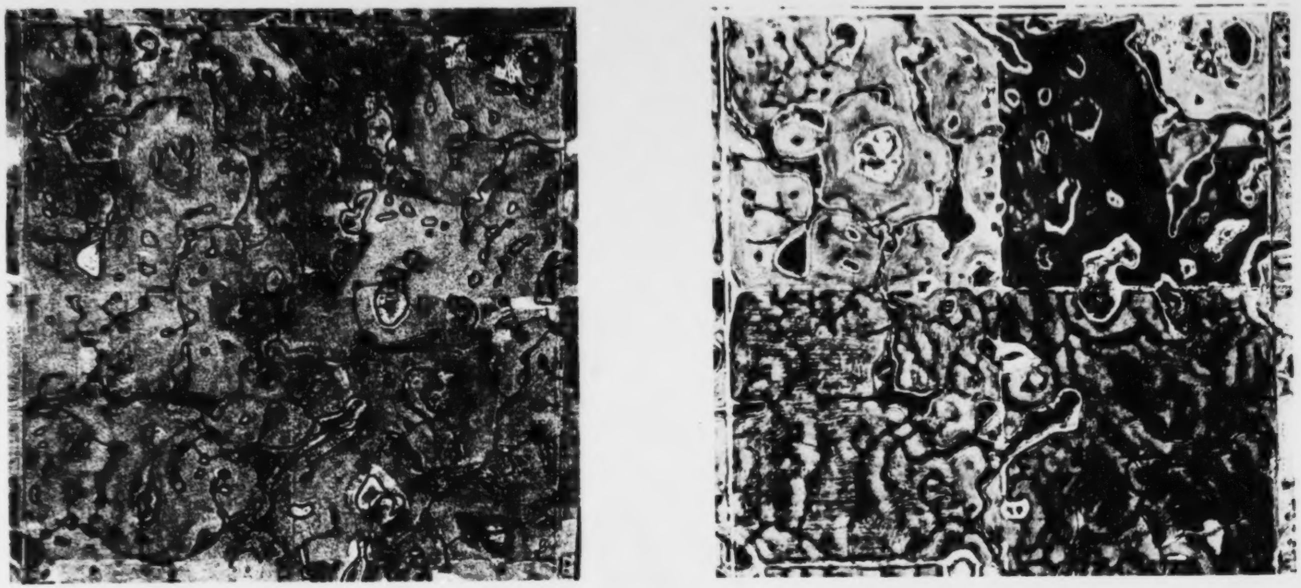
Section 7 Tp 24 R 31 W 1

Figure 3.50
Wetland Air Photo Analysis 1998



Source: Ducks Unlimited

Figure 3.51
Aerial Photo 1949 and 1998



1949 base photo

April 1998

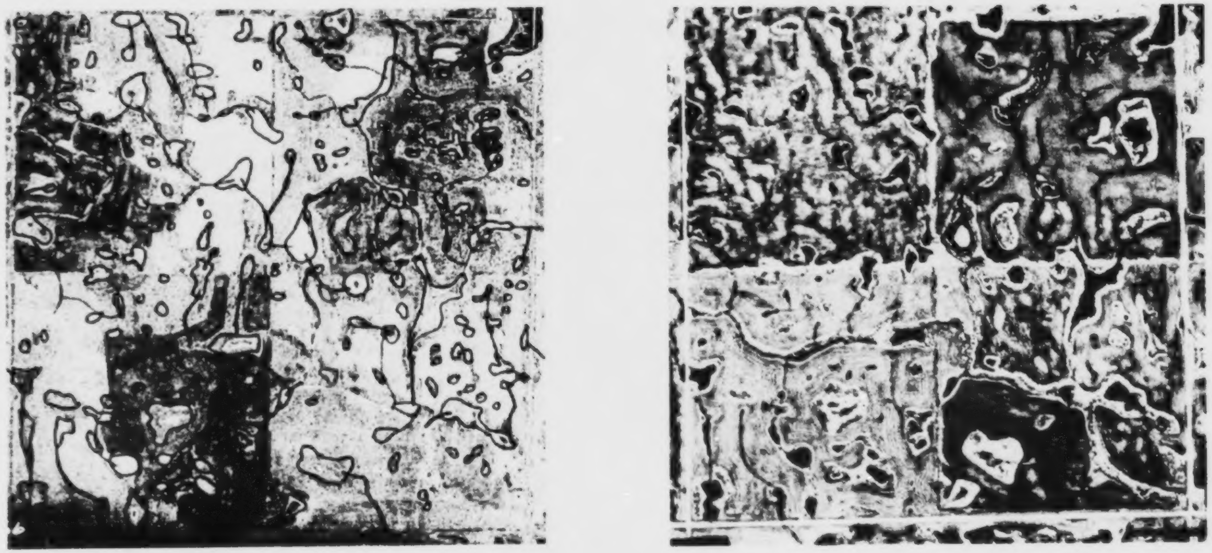
- 127 wetland acres in 1949
- 102 ac (80%) impacted by 1980
- no activity since 1980

- wetlands delinieated
- drainage works plotted

Blue = ditch placed < 1980

Sec 8 Tp 33 R 6 W2

Figure 3.51 - continued
Aerial Photo 1949 and 1998



1949 base photo

April 1998

- **113 wetland acres in 1949**
- **58 ac (51%) impacted by 1980**
- **80 ac (71%) impacted by 1998**

- wetlands delinieated
- drainage works plotted

Red = ditch placed < 1980
Blue = ditch placed < 1980
Sec 8 Tp 33 R 6 W2

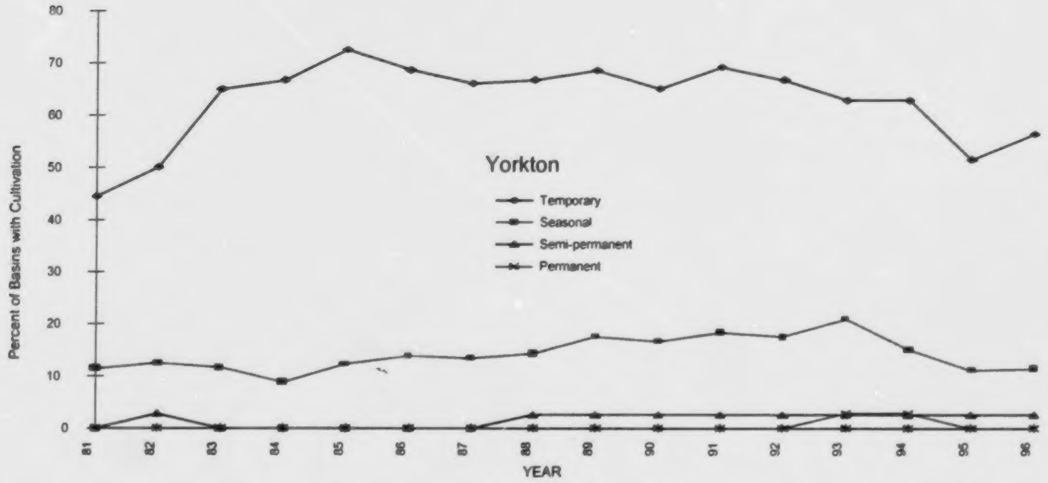
The aerial photo study of four townships in the Churchbridge area found that the wetland area affected between 1950 and 1998 ranged from 39 to 60 percent, with an average of 54 percent. Between 1980 and 1998, the wetland area affected ranged from 8 to 21 percent with an average increase of 13 percent in affected acreage. Figure 3.51 provides an example of the aerial photo analysis.

3.5.3 Ground Survey

These surveys by the CWS recorded agricultural activities in wetland basins and margins along five survey transects. Activities noted were cultivation, drainage of basins, clearing of woody vegetation, and filling, burning, haying and grazing of basins and margins. The following points summarize some aspects of the agricultural impacts on wetland basins and margins based on the results of the ground surveys.

- Many basins of temporary wetlands are completely cultivated, and of those with some basin or margin left, the area cultivated is high. Seasonal wetlands are less subject to complete cultivation of the basin, and very few semi-permanent and permanent wetlands are completely cultivated. The presence of surface water, or very moist soil, limits cultivation of these more permanent basins except after periods of prolonged drought. Figure 3.52 illustrates the percent of basins cultivated in the Yorkton transect.

Figure 3.52
Percent of Basins with Cultivation Yorkton Transect



Margins of many temporary and seasonal wetlands are also completely cultivated. There appears to be a gradual attrition of the margins of all remaining wetland base types over time. Figures 3.53 and 3.54 show the percent of basins along the Yorkton transect with all margins cultivated and with some remaining margins.

Figure 3.53
Percent of Basins with Margins Completely Cultivated Yorkton Transect

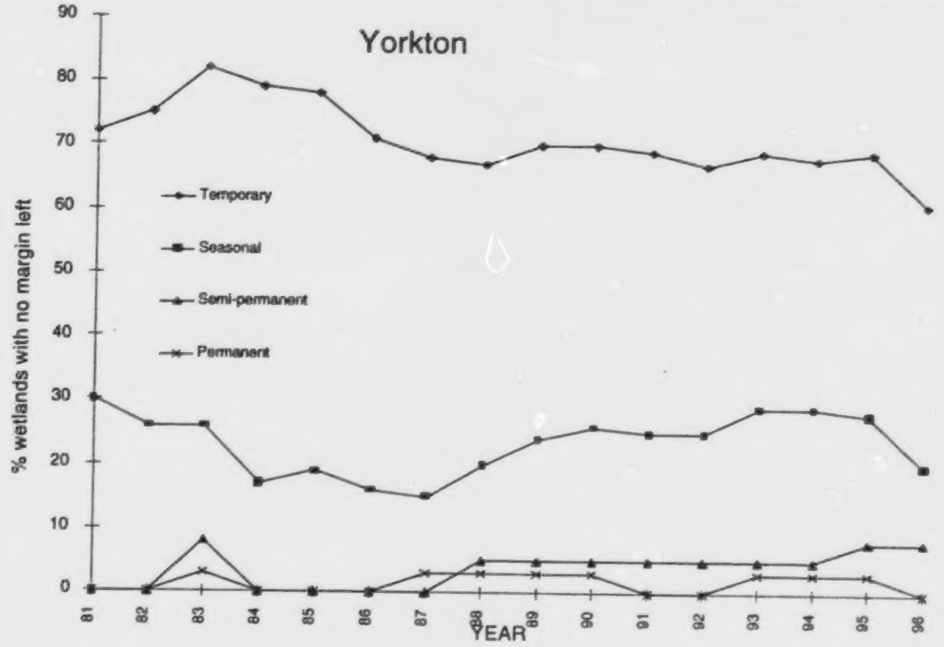
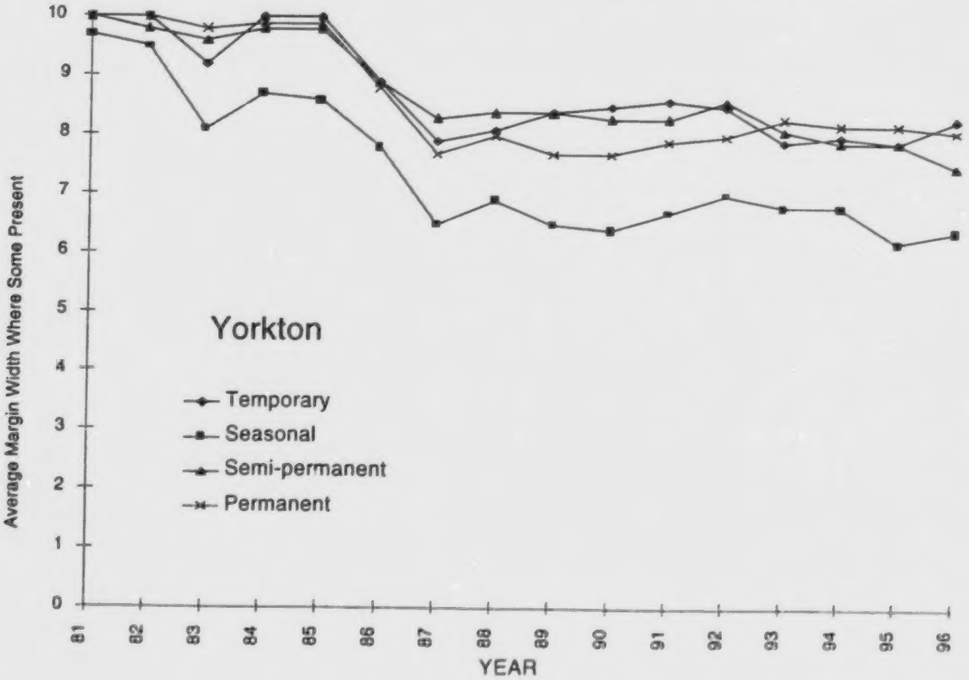


Figure 3.54
Percent of Basins with Some Remaining Margins Yorkton Transect



- Drainage of water from the basins of wetlands is often difficult to detect. Drainage appeared to occur on occasion in the Basin at all wetland base types. Drainage did not appear to occur after the late 1980s along the Yorkton transect, is recently occurring in the Penrith transect, and has been regularly occurring in the Buchanan transect. Figures 3.55 and 3.56 show the percent of basins in the Yorkton and Buchanan transects with evidence of drainage.

Figure 3.55
Percent of Basins with Evidence of Drainage Yorkton Transect

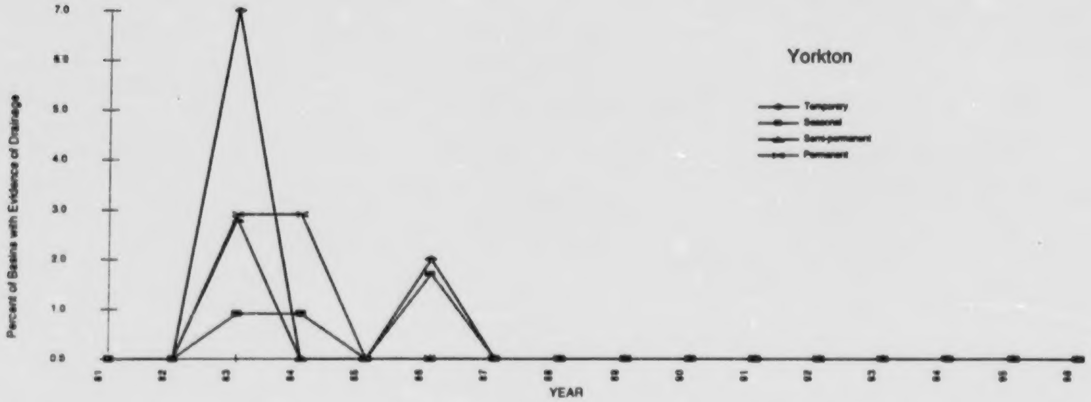
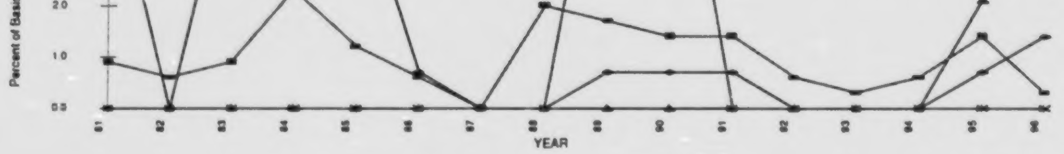
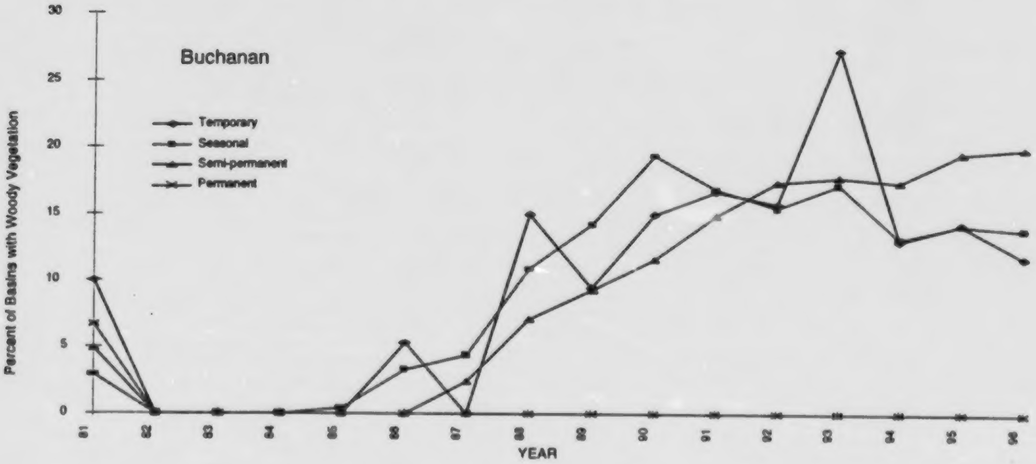


Figure 3.56
Percent of Basins with Evidence of Drainage Buchanan Transect



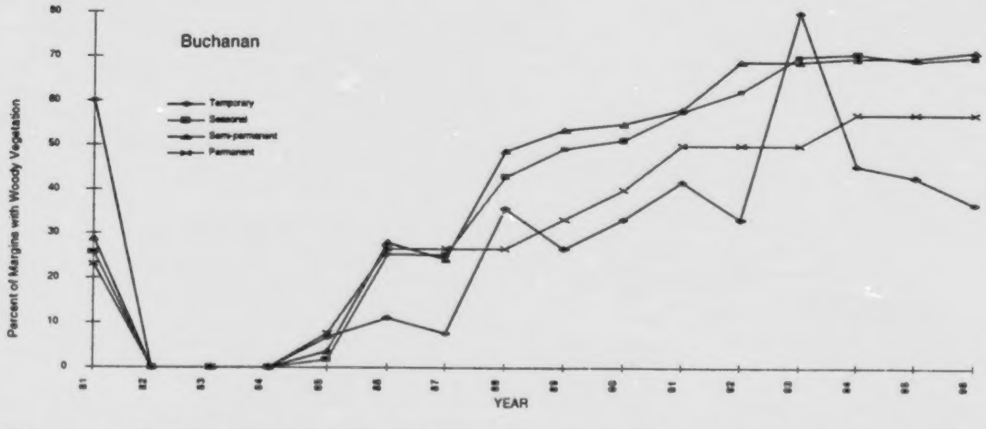
- Some wetland basins in the Basin have had their woody vegetation removed. When this occurs, usually most or all of the woody vegetation is removed. Clearing appears to be frequent in the Buchanan area in the 1990s. However, woody vegetation appears to be increasing in the basins for most types of wetland basetype, suggesting that the amount of clearing of woody vegetation is not exceeding new growth. Figure 3.57 shows the percent of basins with some woody vegetation along the Buchanan transect.

Figure 3.57
Percent of Basins with Some Woody Vegetation Buchanan Transect



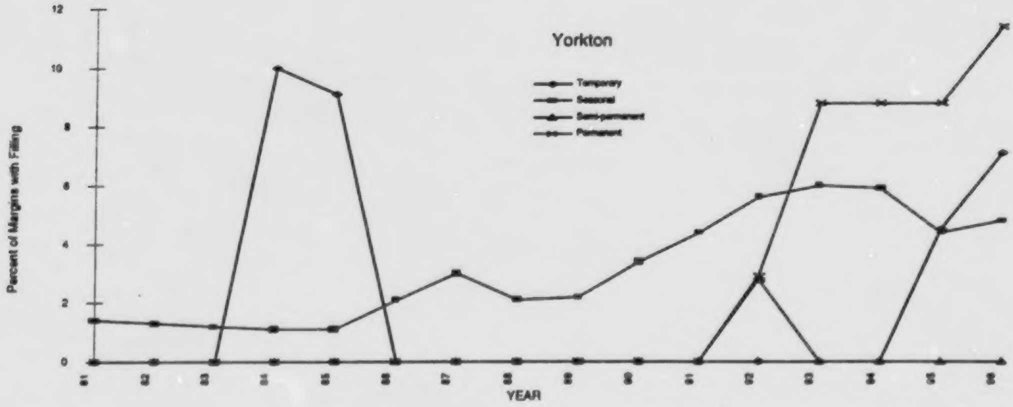
- Similarly many margins of wetlands of the Basin have increasing amounts of woody vegetation. Clearing continues to occur in all areas, particularly in the Buchanan area, but growth of vegetation may exceed that cleared. Figure 3.58 shows the percent of margins with woody vegetation along the Buchanan transect.

Figure 3.58
Percent of Margins with Some Woody Vegetation Buchanan Transect



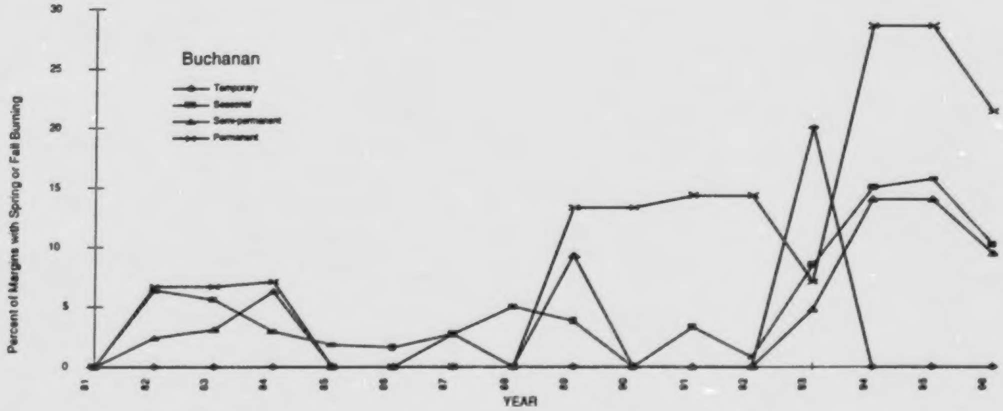
- Filling in wetland basins and margins (stones, refuse, woody debris from clearing) may be increasing in the 1990s in some areas such as Yorkton and Penrith but it involves relatively few wetlands, and a small proportion of the basin and margin areas. Figure 3.59 shows the percent of basins with evidence of filling along the Yorkton transect.

Figure 3.59
Percent of Basins with Evidence of Filling Yorkton Transect



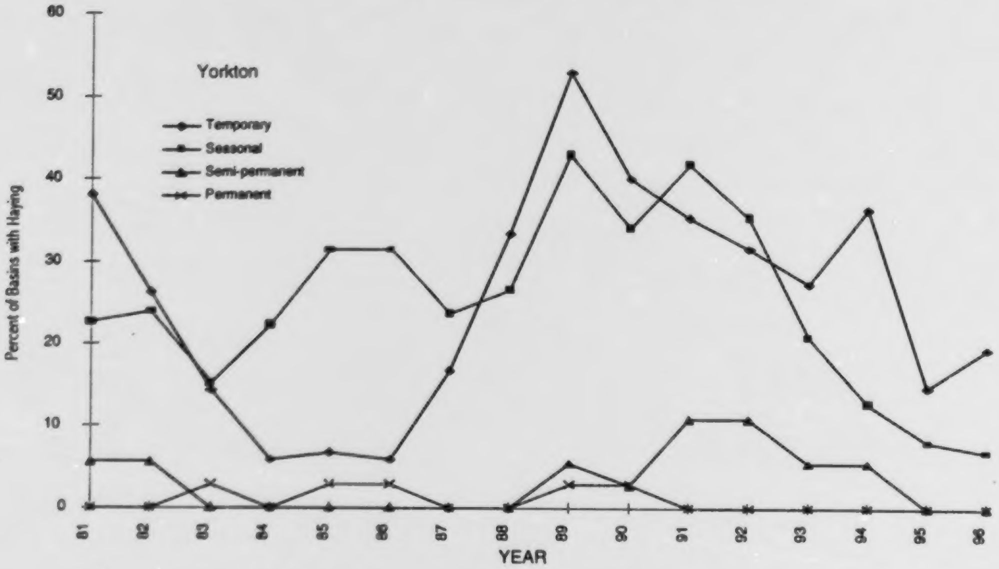
- Burning of basins and margins to remove weeds occurs regularly at wetlands within the Basin but relatively few wetlands are affected. Burning may be increasing in the Buchanan area. Figure 3.60 shows the percent of margins along the Buchanan transect with evidence of burning.

Figure 3.60
Percent of Margins with Burning Buchanan Transect



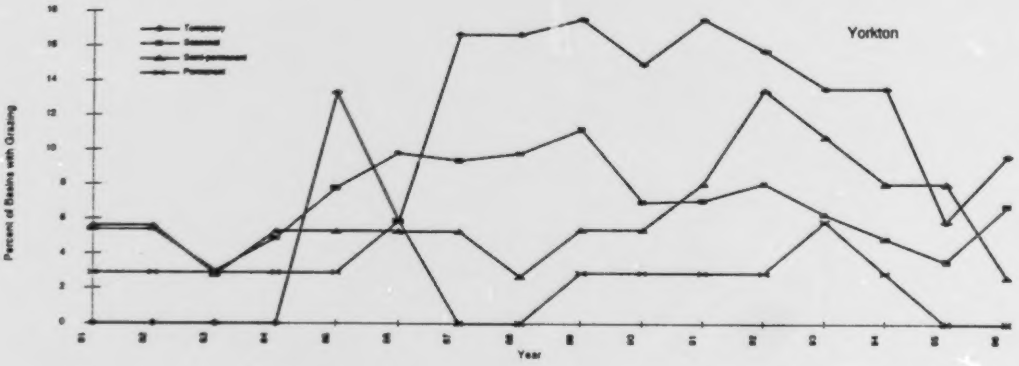
- Haying of the basins and margins of wetlands is common within the Basin. It appears to be more common in basins in dry periods which may reflect access to this vegetation, and perhaps reduced availability of tame forage. Figure 3.61 shows the percent of basins with haying along the Yorkton transect.

Figure 3.61
Percent of Basins with Haying Yorkton Transect



- Grazing of basins and margins of wetlands also occurs commonly within the Basin. No distinct pattern related to moisture conditions or wetland type is evident. Figure 3.62 shows the percent of basins with grazing along the Yorkton transect.

Figure 3.62
Percent of Basins with Grazing Yorkton Transect



3.5.4 Channel Clearing and Maintenance

At the onset of settlement of the Prairies the larger, natural waterways along with the riparian zone were usually left in their natural state while the surrounding uplands were cleared and broken. These naturally wooded and grassed waterways and riparian areas were often the only remaining wildlife habitat in the area. Smaller tributaries and upstream runs were usually cleared and cultivated. Over time these natural waterways can become choked with silt, vegetative growth, deadfall, debris, and the effects of beaver activity. The accumulation of this material can restrict the natural conveyance capacity. As a result adjacent farm land becomes more susceptible to flooding and erosion.

History has shown that the usual progression of land development is for producers to drain wetlands and clear willow and aspen growth along streams in an effort to create larger fields with fewer barriers to cultivation. The goal is to maximize acreage and improve farming efficiency. The result is that cultivation has further encroached into flood plains and riparian areas of watercourses. Thus these areas are very flood prone. The flooding is often magnified by upstream changes within the watershed and waterways.

Overbank flooding is a natural phenomenon. The floodplain permits a stream to dissipate its energy naturally by decreasing the water velocity and reducing the potential of a stream to erode and to carry sediments. Floodplains are often very fertile areas. Floodplains, recharged regularly with sediments, nutrients, and moisture, may support vigorous plant growth.

When agricultural land adjacent to the waterways, particularly cultivated acres, is perceived as flood prone, the usual solution is for producers, developers, and local governments to undertake channel clearing. Channel clearing is a measure adopted to improve stream hydraulics, facilitate the free flow of water and reduce the impacts of flooding. Occasionally all tree and brush growth as well as cover in the riparian area is removed. The reason is to prevent further tree growth and to remove potential future building material for beaver. Occasionally, the channel is reshaped, or realigned. Reestablishing grass cover and buffer strips after channel clearing and channelization has not been the usual remedial practice. Channel clearing often represents an attempt to remedy problems caused by upstream land use decisions.

Once the channel clearing process in waterways is initiated, the remaining wetlands within the watershed become more susceptible to further drainage because the perception of the upstream landowner is that an adequate downstream outlet exists.

3.5.5 Road Development

In the late 1800s and early 1900s, federal legislation encouraged drainage to bolster land development for agriculture and road building to service the growing population. Various statutes, often with independent objectives, facilitated drainage. Initially, rural municipalities (RMs) developed roadways without assistance from the provincial government. The first roads were constructed by blading and predominantly had nongravelled surfaces. They were built without much roadside drainage and followed land contours. Often they were built around the larger, more permanent wetlands. As more land was developed for agriculture, the natural runoff regime was significantly altered resulting in increased washouts and submergence of roadways. The public demanded more roads and more efficient and safer roads for heavier loads, increased traffic density, and faster vehicles. The outcome was the construction of new roadways and the conversion to graded, drained, and gravelled road specifications.

In 1955, the Saskatchewan Government announced a financial assistance program to RMs resulting in the construction of approximately 19,320 km of main market grid roads. In 1967, a program to assist RMs to construct a system of main farm access roads was adopted. In 1977, the primary super grid road program for construction, oil surfacing and maintenance was launched. Over the years there has been a dramatic shift in the road type and standards as well as the number of kilometres of roads. In 1991, there was a total of 138,696 km (RM roads) in Saskatchewan and in 1996 there were 162,157 km, an increase of 17%. Table 3.13 provides more detail.

Table 3.13 - Road Development in Saskatchewan Rural Municipalities

Road Description	1961-64	1993-96
bladed, undrained	58%	26%
graded, drained	33%	44%
high standard, graded, drained	9%	30%

The evolution of road type was accompanied by upgrading of roadway design standards. High density traffic, increased speed, and heavier loads require controlled alignment and grades as well as a stable sub-grade which requires efficient roadside drainage. Efficiencies in the road transportation network over the years has been achieved with the corresponding loss of some wetland and associated habitat. Mounting public concern includes the impact of municipal roads and provincial highways on natural drainage patterns and wetlands.

Rural municipal councils have the authority to control private drainage within and into roadside ditches. However, there is a reluctance for most RMs to exercise this authority. Runoff which used to travel overland from parcel to parcel and slough to slough is now drained into roadside ditches which discharges to tributaries of creeks and rivers. A nearby roadway conveyance ditch may encourage individuals to drain water from their land to these roadway ditches.

Private drainage may increase flow volumes and peak discharges at municipal road hydraulic structures. To appease local public pressure to alleviate flooding concerns, a RM may increase the capacity of the structures. The costs to maintain and prevent a road grade from sustaining damage are passed on to the taxpayer. With fewer wetlands to capture and store runoff as well as fewer natural runways, the higher flood volumes may increase erosion. These additional silt loads are frequently deposited at road structures. This may cause obstructions or blockage of the hydraulic structures which could lead to structure failure and/or roadway deterioration and eventually require costly repairs.

The cumulative effect of enhanced drainage efficiency, both within and from RM to RM, on downstream watersheds has increased stress on natural channels and river systems and the associated structures that must pass these flows. As downstream municipalities attempt to contend with flooding problems associated with the cumulative effects of drainage and enhanced drainage efficiency, the normal progression is to first increase culvert sizes followed by replacing culverts with bridges, and finally a single span bridge may be replaced with a multi-span bridge. Each upgrade has a corresponding cost increase.

3.5.6 Beaver Control

The beaver is a common inhabitant located throughout most of the watercourses within the Basin. Beavers are an essential part of the prairie ecosystem and beaver ponds function as wetlands. Beaver control water levels by constructing low head dams which often conflict with agricultural land uses and adversely affect roadways. When beaver dams are breached or washed out, the released water causes downstream damage to farmland, roads and culverts. Today, with relative freedom from trapping and few natural predators, beaver populations have increased to the extent that producers and RMs consider them as a nuisance or pest. In some areas within the Basin, lands that have been secured as wildlife habitat are seen as "safe havens" for beaver and act as a source from which potential colonizing beaver radiate.

Responsibility for natural resource management, including beaver and other wildlife, was transferred from federal to provincial jurisdiction in 1930. Beaver populations were very low at that time due to previous extensive trapping. Populations remained low throughout the 1940s and 1950s. Major conservation efforts, including relocation, were directed towards enhancing beaver populations.

Populations greatly increased in the 1970s. Declines in fur prices combined with habitat improvements in response to wetter conditions were responsible for this growth. Flooding complaints associated with this population growth prompted the province to reduce the protected status of beavers in the early 1980s. Regulatory amendments allowed RMs to designate beaver a nuisance animal and permitted disposal of problem beaver. A special provincial nuisance beaver program was delivered through the former Saskatchewan Parks and Renewable Resources from 1984-1986. The drier conditions of the 1980s coupled with higher fur prices moderated nuisance beaver problems.

In the early 1990s normal and above normal precipitation resulted in wet conditions in the northern and eastern regions of the province. Flood damage to land and roads was exacerbated by a resurgence in beaver populations. The RMs pressured government for assistance. Although Sask Water, Sask Environment and Resource Management (SERM), and Sask Municipal Affairs, Culture and Housing were involved in some way with beaver management, the activities lacked coordination. The three agencies developed a three element strategy as an enhancement to Sask Water's Channel Clearing program. This included a subsidy (50% assistance to a maximum of $5.00) paid on the basis of beaver tails submitted to RMs by trappers hired during the fur season.

The enhanced program ran from May 1, 1994 to December 31, 1995. In 1994 the enhanced program paid a subsidy on 3,950 beaver tails, and on about 5,300 tails in 1995.

Beaver pelt prices have an effect on the total provincial harvest. In 1980-81 there were 22,516 trapping licences sold with 76,400 beavers harvested at an average value of $24.62 per pelt. In 1992-93 there were 3,240 trapping licences sold with 16,194 beavers harvested at an average price of $15.00.

A number of problems are associated with beaver management.

- During high populations, beaver activities have resulted in considerable hardships and financial losses in the Basin.
- No single agency is assigned responsibility for coordinating beaver management. Landowners, and local and provincial government agencies look to one another to assume responsibility.
- Provincial legislation does not provide authority for provincial officers to enter land to remove beaver dams.
- Removal of beaver dams can result in liabilities for downstream flooding.
- Agricultural cropping practices have encroached on riparian areas so that water ponded by beaver dams can cause flood damage.
- Once beaver dams are removed, ongoing maintenance is needed to control nuisance populations. Often this maintenance is not done which results in a reoccurrence of the problems.
- Past programs to fund beaver management have been reactionary in response to high beaver populations. Areas subject to problem beaver populations need to be managed on a continuous basis so that timely actions can be taken when populations become a problem.

An approach is needed to address problem zones. Information and education are key components of this strategy. Fact sheets, workshops, demonstrations, and extension programs on beaver control and beaver dam devices are examples of possible education tools. Another innovation to address wildlife management concerns in a proactive manner has been the formation of public advisory committees such as was recently established in the Moosomin region.

3.5.7 Impact of Government Programs and Policies on Land Use

When the Prairies were originally settled in the late 1800s and early 1900s, the purpose was for agricultural development. Under *The Homesteads Act*, an individual could gain ownership of a quarter section of land by living on that quarter and by breaking it for crop production. The original surveying of the Prairies where the landscape was divided into a grid system of quarter sections influenced land use. Roads were built on this grid system, often regardless of whether the road passed through a wetland, tree bluff, or hilly terrain.

After the original settlement of the prairies, governments continued to encourage cultivation through their farm programs. The intent of most agricultural programs was to bolster farm income. These programs provided financial support to producers growing grains, oilseeds and more recently, special crops. Support programs favoured cultivation over other land uses. For example, in 1986 the federal government introduced the Canadian Special Grains Program, a one time, one billion-dollar payment to Canadian producers to compensate them for low grain and oilseed prices. Only farmers growing grains and oilseeds received aid. Another example, the Gross Revenue Insurance Program (GRIP), was in effect from 1991-1994. GRIP provided financial support for the grains, oilseeds, and special crops sectors. By assisting these sectors, GRIP continued to encourage cultivation over other agricultural land uses such as hay and pasture.

Other government subsidies and institutional policies, in conjunction with farm income support programs influenced land use. The Canadian Wheat Board's (CWB) acreage-based quota allocation was established to give every farmer fair access to market grain. By using cultivated acres to calculate a farmer's allocation or quota, producers could increase their allocation by bringing more acres under cultivation. The incentive of increased allocations may have encouraged producers to drain wetlands, break native grasslands, and clear trees. In the 1994/95 crop year, the CWB changed from a quota allocation, based on cultivated acres, to a direct contract system. The contracting system does not create the motivation to convert additional acres to cultivation.

The *Western Grain Transportation Act* (WGTA) lowered the farmers' cost of transporting grains and oilseeds to an export location making grain and oilseed production more profitable. With relatively higher profits from growing grains and oilseeds compared to other land uses, producers had incentive to increase their acreage seeded to grains and oilseeds by breaking land considered marginal for crop production. The WGTA was repealed in 1995.

In recent years, governments have moved to a 'whole farm' approach for income support programs. For example, since 1994, the Net Income Stabilization Account (NISA) program includes all farm commodities except those under supply management. The Agricultural Income Disaster Assistance (AIDA) program is in place to stabilize income from all farm sources. These more recent programs have little effect on land use decisions made by the agricultural sector.

3.6 Impacts of Habitat Change and Loss on Wildlife

Wildlife habitat, and its value to a myriad of species, normally undergoes constant change. Changes can occur seasonally, or over relatively shorter or much longer periods of time. Both the quantity and quality of habitat may change in any given area as a result of such natural events as flooding, wind and water erosion, fire, plant succession and climatic changes. Changes in land use may accelerate natural changes in quality and/or quantity of wildlife habitat. While some habitat alterations are beneficial or valuable to the ecosystem as a whole, others, such as land drainage and clearing, filling of wetlands, breaking of native grassland, cultivation, grazing, haying, burning, channel clearing, road building and agricultural chemicals have a negative impact on wildlife habitat.

The extent and duration of change in habitat result in different responses by different species. For example, if a wetland dries up, is drained, burned or cultivated, wetland plants may grow again if there is adequate seed or root remaining in the soil, when normal water levels return. Some invertebrates may remain in a dormant life phase that enables them to survive until sufficient water is present to re-establish a population. The ability of wetland species to respond to increased water depends on a number of factors such as the extent and length of the disturbance or increased water availability.

The most direct effects on wildlife occur when their habitat is modified or removed. Some plant and animal populations may decrease in numbers, while others may increase, and some may even move to another location. Some species may be able to adapt to the altered habitats. For example, certain plants and animals are able to respond to drought or flood conditions and may temporarily increase in numbers. Animal species may be affected by a change in habitat, to the extent of not having adequate habitat to support some aspect of their life cycle, such as breeding, foraging and overwintering which could result in a population decrease. Habitat changes may be extensive enough to result in the elimination of a species or a reduction of their numbers so that the species is not able to maintain a sustainable population.

Plant and animal inventories in the Basin are not sufficient to fully evaluate the effects of recent alterations to various habitats. More is known about those plants and animals which are most visible. For example, records on birds and larger mammals are most likely to have been noted. Plants, small animals or invertebrates, which form the basis of the food chain for larger animals, are not as well inventoried or monitored. Some animals move from one region to another and often it is only when a population decline is apparent that people begin to look for a cause. Some bird species, for example, are believed to be declining in numbers and the causes may be linked to one or more habitats used by these birds during different parts of their life cycle.

The response of waterfowl populations to increased precipitation provides an example of the potential, long term effects of habitat change. Moisture conditions in the Prairies improved beginning in 1994. However, the duck populations have not responded as might be expected due to below average brood production. This poor reproductive success can likely be attributed to habitat reduction. In the Dakotas and the pothole region of Montana and Minnesota nest success has improved dramatically during the same time period. In the 1970s, prairie Canada attracted about 75 percent of the duck population and produced about 75 percent of the young. During the 1990s, the pothole region in the northern United States attracted about 25 percent of the duck population which produced about 75 percent of the young. This change in distribution of nest success can be attributed to the increased habitat in the northern states provided by the Crop

Reserve Program (about 2.5 million hectares of perennial cover). Over the last 30 years, about 2.5 million hectares of land in prairie Canada have been changed from "unimproved" to cultivation.

There are numerous "man-made" actions which may have an impact on wildlife habitat. The following descriptive list of activities and their effects on habitat is meant to demonstrate that the cumulative net effect of a specific action or a combination of them, results in a negative effect on wildlife in its broadest context. In the Prairie parkland area, wildlife habitat has been impacted since the time of permanent settlement. The Prairies represent some of the most altered landscapes on the earth. The degree to which any wildlife species depends on a particular type or variety of habitat types, upland and wetland, is not well understood. The relationship may be straight forward or alternatively, extremely complex. As some of these habitats diminish it becomes evident, perhaps too late, that the survival of a species is, or was, dependent on a specific type of habitat or combination of habitats.

3.6.1 Burning

Wildfires on the Prairie occur either naturally or are caused by people. If uplands or wetland margins are burned in the spring, fire can reduce nesting cover, destroy early nests of ducks, geese and other early nesting species and cause mortality to both hatched birds and adults. Upland areas burned in spring or early summer may also have negative effects on habitat that is utilized as nesting cover for a variety of bird species. Similarly, uplands, wetlands and their margins burned in the fall offer a bleak landscape to returning birds the following spring, or to upland birds, deer, and other animals, dependent on older growth habitat for nesting and rearing young. Burning can have a positive effect on habitat by creating openings in dense stands of cattails, bulrushes or reed grass in, or adjacent to, wetlands. Fire may also enhance the habitat by releasing previously tied up nutrients into the ecosystem. Succession may be altered by fire and the biodiversity may be enhanced. All landowners, including producers and wildlife managers, as agents of habitat control or condition, need to evaluate the positive and negative effects of fire on habitat before proceeding with burning.

3.6.2 Clearing

In areas with soils suitable for agriculture, upland wildlife habitat is in jeopardy of being bulldozed to create land for annual crop or tame forage production. Prairie parkland forest, mixed forest and shrub land and native prairie have been progressively cleared and broken since settlement. The impacts on wildlife include the loss of thermal winter cover for big game such as deer or elk, nesting habitat for many species of neotropical songbirds, and habitat for woodland raptors, furbearers and rodents. Animals and birds displaced from cleared areas must either move to similar habitats elsewhere to survive, or perish. Even if they find suitable habitat it may not be available because many species are territorial.

Habitat fragmentation is becoming more of a concern in the prairie/parkland regions. As different types of habitat are increasingly affected, the quantity of habitat that is necessary to sustain animals or birds becomes less and is broken into smaller and smaller fragments. These habitats become more isolated and spatially separated, and lose important linkages used as travel corridors. The cumulative effects of fragmentation and isolation make it more difficult for animals to survive. As a direct result there is real potential for a loss in species diversity within a given area.

3.6.3 Drainage

The loss of wetlands has major impacts on wildlife. Numerous species of ducks, shorebirds and other birds which inhabit wetland environments, may have a component of their life cycle interrupted when a wetland is drained. In addition to the destruction of nesting cover, such critical aspects as the diversity of aquatic organisms that are food to a host of wetland birds disappears, escape cover for young broods is unavailable and traditional molting/loafing areas are lost. Wetland vegetation provides abundant quantities of food for birds as well as amphibians, fish, reptiles and insects. Wetland furbearers such as muskrats, mink and beaver must move to new locations. Often they die en route while searching for suitable aquatic areas. If they do find suitable habitat it is usually occupied. This leads to stress, physical conflict and possibly death. In a direct proportion with the furbearer population reduction the potential revenue from a sustainable harvest of these species can be lost. Other impacts of drainage are the likelihood of increased salinity in the drained wetland basins, the possibility of downstream flooding, and potential sedimentation in ditches, creeks or waterways. Once a wetland is permanently drained and the land subsequently cultivated, it is unlikely that the wetland will be restored to its former value, even under the most intensive management efforts. Partial drainage lowers the natural spill elevation of a wetland. This may affect the wetland characteristics and make it more susceptible to drought.

3.6.4 Filling

Farm machinery has increased in size at the same time as the demand for cropland has increased. Increasingly, landscapes are being substantially altered by drainage of temporary or semi-permanent wetlands. After drainage is complete, the area may be improved by levelling hilltops and using this excess material, as 'earth fill' for the remaining depressions. Any possible opportunity for the depressions to function, even temporarily, as a wetland is lost. The impacts wildlife species face when drainage or clearing occurs is further exacerbated by the landscaping process of filling of wetland depressions.

3.6.5 Road Building and Maintenance

Unlike the northern shield or the mountainous and rock country of Western Canada, the prairie and parkland regions generally do not have many major obstacles to road construction. Historically, farm access or grid roads have been developed on section lines and generally were straight. Slight deviations around wetlands or lakes were often necessary because of the cost of construction. However, in recent times, grid roads are having to withstand greater traffic volumes and heavier and larger equipment, thus necessitating road upgrading or reconstruction. Wetlands are more likely to be impacted either in their entirety or along the margins.

The design and construction of roadways require drainage of the road bed. These road ditches are linked to natural runs and watercourses. Thus, surplus water is removed from the road edges. It is also possible to drain wetlands that are in close proximity to these ditches. In fact it is said that some roads have been constructed primarily to provide an outlet for drainage of wetlands. In addition to degraded and lost habitat there is an increased possibility of contamination by petroleum fuels and pesticides.

3.6.6 Grazing

As with burning or haying, grazing can be either compatible or detrimental to uplands and wetlands and their margins. Excessive or over-grazing and/or trampling by livestock can reduce nesting and escape cover, and temporarily or even permanently damaging some species of emergent forbs, sedges or cattails. Overgrazing reduces the density and biomass of many plant and animal species, reduces biodiversity, interrupts ecological succession, impedes nitrogen cycling and changes habitat structures. Excessive grazing in riparian areas can severely damage riparian habitat, destroy streambank trees and shrubs, which are habitat and food for big game, as well as contributing to stream sedimentation, increased water turbidity and overall water quality. Allowing livestock uncontrolled access to streams can also result in nutrient loading from manure deposition.

3.6.7 Haying

Many species of birds nest on the margins of wetlands or at some distance from the actual waterbody, and not during the same time period. Haying of margins or the associated uplands can destroy nests of ground nesting species if conducted in June and early to mid July. The longer that haying can be delayed the less likely that nest destruction will occur. Haying in late July or August on native grasses is acceptable. Haying of wetland margins will decrease available nesting habitat significantly. Nest success in tame forage stands can be decreased by early summer haying.

3.6.8 Channel Clearing and Maintenance

Stream channels and the assorted riparian habitats provide valuable habitat to a diversity of wildlife. Clearing of the riparian habitat and excavation of the stream channel will have an impact on virtually all types of invertebrates, fish, reptiles, birds, animals and amphibians that rely on these habitats at some time of the year for some stage of their life cycle. Channel clearing and subsequent maintenance essentially remove these areas as functional ecosystems, which are valuable to the watershed. The disruption and loss of riparian habitat has water quality implications as well.

3.6.9 Pesticides and Herbicides

Agricultural spraying of lands proximal to wetlands or adjacent uplands, for either weed control using herbicides or insect/plant disease control using pesticides may have a definite negative impact on wildlife in the area.

Herbicides eliminate weeds, grasses, sedges, cattails, bulrushes, forbs and shrubs that grow in wetlands, on their margins or in the adjacent uplands. All of these plants contribute in some way to the benefit of some species of wildlife. Eradicating the vegetation that creates the habitat and aquatic substrates for algae, invertebrates and insects upon which a multitude of species ultimately depends decreases the capacity of any wetland to produce and maintain wildlife.

Similarly, pesticides used for exterminating such things as insect pests, moulds, and fungi, which decrease agricultural crop production, can have effects on wildlife by reducing the food sources that many species thrive on. Pesticides and herbicides carried by wind or water to wetlands can kill a host of invertebrate organisms that are at or near the bottom of the complex food chains upon which many birds, animals, reptiles and amphibians are dependent. As these food sources are affected by spraying or the chemicals deposited in a wetland, the dependent species will be affected in some manner, from outright death to reduced breeding or nesting success.

3.7 Social and Economic Considerations Associated with Wetlands and Uplands

This section presents an overview of the benefits and uses of wetlands and uplands. Land management practices such as channel clearing and road development are discussed. Landowners' concerns about wetlands including beaver control and information on waterfowl depredation and compensation are presented.

3.7.1 Wetland and Upland Benefits

Wetlands provide a number of hydrological and ecological functions as well as economic benefits. Prairie wetlands are of immeasurable ecological value because they provide habitat for many plant and animal species and because of the roles they play in water purification, flow stabilization, flood control, and in some situations ground water recharging. Wetlands provide areas for livestock watering and wild hay production, a source of domestic water, recreational activities, and consumptive uses such as hunting, trapping and fishing.

Native uplands also provide economic and ecological benefits. Native forages provide livestock feed, especially in times of environmental stress. Upland vegetation is an essential habitat component in the life cycle of many species. Many native plant species have medicinal benefits; some of these are just being discovered. Native uplands provide habitat for insect species; some of these can benefit agriculture as pollinators or predators of crop pests. Uplands also provide recreational opportunities.

3.7.1.1 Ground Water

Continental glaciers covered the northern prairie regions and left extensive glacial deposits. These deposits can be hundreds of metres thick and consist of glacial tills, interspersed with deposits of clays, silts, sands and gravels. These clay and till deposits occur mostly as continuous deposits that can extend hundreds of kilometres. The high clay content results in very low permeability. The sands and gravels occur as extensive sheets, long narrow channel deposits and numerous small localized deposits. These areas have high permeability and form the local and regional aquifers. Most of these aquifers are isolated from each other.

The same glacial processes described above were responsible for forming the surface topography. Depressions that were left have evolved into wetlands. Water within the wetlands is generally connected to and continuous with, the water table in the surrounding areas. The specific topographic location of a wetland within the watershed reflects how the wetland will function. Wetlands in the upper section will primarily recharge, wetlands at mid slopes will perform as ‘flow through’ wetlands and wetlands at lower portions are more likely to be discharge sites. These are all interconnected via a shallow localized water table or ground water system. A larger regional aquifer normally lies below this system.

Although the recharge function of wetlands plays an important role in prairies, it applies mostly to localized groundwater systems. Only a small proportion of the recharging water reaches the regional aquifers. Thus, in general, wetland drainage will have little effect on regional water supplies or the elevation of the regional water tables. The opposite may be true for dugouts or local shallow wells. Wetland drainage in this situation could result in a substantial lowering of the well yield and water level. Wetland retention may result in increased stability, especially during dry cycles. Often the water quality of a well decreases as the water table is lowered. There may be situations where wetlands have a significant role in regional aquifers. If there are areas where the regional recharge values are relatively high, intense wetland drainage could have negative effects.

Within shallow aquifers, wetlands likely play a similar role in the dynamics of water quality as in surface water. Large wetlands located lower in the catchment area receive groundwater discharge. Consideration should be given as to their function as storage sites of water high in sulphate salts.

The relationship between wetlands and groundwater is complex. It requires further research and investigation, in particular, as it applies to the Upper Assiniboine River Basin.

3.7.1.2 Water Quality

Wetlands improve the quality of inflowing waters by the following three basic methods:

1) Wetlands deposit sediments through velocity reduction and the filtering action of vegetation. The removal of toxins and heavy metals occurs as these substances become attached to soil particles suspended in the water. When the sediments are deposited within wetlands, the toxins remain attached and settle to the bottom of the marsh.

2) Chemicals are removed or transformed by plant uptake, sediment deposits and microbial action. Plants such as cattail are able to utilize and store phosphorus, nitrogen and heavy metals. Microbes alter various contaminants as sources of nutrients or energy.

3) Wetlands remove pathogenic organisms by the action of microbes which inhabit wetland ecosystems.

Basin wetlands are natural regulators of pollution through a variety of ecological processes. Aquatic plants and algae metabolize dissolved nutrients such as phosphates and nitrates aerobically through photosynthesis. Anaerobic conditions of the wetland bottom permit denitrification of soluble metals to insoluble forms and adsorption to surrounding sediments, which is crucial to the purification of water containing dissolved solids. Decomposers then break down these complex chemicals, or they are immobilized in sediments, in which case they don't disappear, but may be mobilized with disturbance.

Wetlands can reduce contaminants from point and non-point sources of pollution. An example of a point source is the use of a wetland complex as a tertiary wastewater treatment process. This technology has had limited applications to date but may prove to be beneficial to smaller communities.

The Basin is an agricultural watershed and thus has potential sources of non-point pollution. Wetlands and other riparian habitats have been proven to be effective in the reduction of biological oxygen demand, phosphorus and nitrogen levels. Lowrance *et al.* (1984) demonstrated that riparian zone vegetation can decrease pesticide and fertilizer movement into streams in areas of intensive agricultural use through uptake by vegetation and denitrification.

Wetland and riparian vegetation act as water purifiers by directly filtering out man-made and natural chemical impurities, and shading water which inhibits algae growth by lowering the water temperature. Also, wetlands and riparian zones continue to slowly release water downstream which can affect water temperature. Water temperature directly affects its oxygen carrying capacity and also alters the metabolic rate of aquatic organisms.

The ability of wetlands to carry out these functions can be severely reduced if the sediment loads reaching the wetlands are excessive. The overload of sediments will impair the aquatic life residing in the wetland ecosystem.

3.7.1.3 Flow Stabilization and Erosion Control

Wetlands provide storage within a watershed and function as dampers within a system. This storage, both temporary and permanent, reduces the volume and the rate of release of runoff from the watershed. Thus the flood hydrograph peak is reduced lessening erosion potential downstream. This aspect is more prevalent during low to moderate runoff events. It is also related to the amount of storage available within the wetlands prior to the runoff event. For example, more storage is available after a year of high evaporative losses.

Riparian wetlands are an ecologically unifying element in the landscape (Rabeni 1996). Like basin wetlands, they perform many important ecological functions. The dense root systems of riparian vegetation stabilize the banks of creeks and rivers. Many herbaceous plants have extensive networks of roots and rhizomes that bind stream banks together, protecting them from scouring ice and fast-flowing runoff in early spring, or during periods of increased flow due to heavy precipitation later in the year. Sheltered banks and ravines along watercourses also regulate spring runoff by staggering the thawing of the winter snowpack. Dense riparian vegetation traps snow during the course of the winter, keeping it shaded as warm spring temperatures melt the snow in exposed areas. This results in the trapped snow melting at a much slower rate, which increases the amount of water that is able to soak into the substrate. This increases soil moisture rather than adding to the runoff from exposed snow and increasing the chance of erosion. Elmore and Beschta (1987) demonstrated that water regulation by riparian wetlands helps sustain water flow later in the season, recharge aquifers, and control runoff.

Vegetation increases the roughness coefficient of a stream cross section spreading the flow of water over a larger area. This lowers the water velocity and hence the potential erosion damage. Finally, vegetation along shorelines dissipates the wave action energy and lowers the shoreline susceptibility to erosion.

The removal of wetlands has serious downstream implications. Increased peak flows as a result of reduced storage will cause more erosion damage within the watercourses and adjacent flood plains. The higher peak flows can also cause erosion damage to stream and river crossings, such as culverts and bridges. There is increased bank erosion. The removal of the vegetation also exposes the soils at the interface between uplands and water and along waterways which increases erosion. The accompanying increased sediment loads transported downstream affect all ecosystems that are directly and indirectly connected to the outlet conveyance waterways. The increased sediment particles reduce the depth to which sunlight is able to penetrate, which in turn reduces the light available for primary production by algae and macrophytes. This has implications to the foundation of local food chains. For example, less production of invertebrates reduces the viability and vitality for waterfowl, shorebirds, and a variety of reptiles and mammals. There is an increase in water temperature which affects the oxygen bearing potential of the water which will have an impact on all organisms that derive oxygen directly from the water. The sediments are deposited downstream and cover the surface of plants in a coating of silt. This has an impact on the plants' functions. Plants which flourish in water can have their seeds covered in a deposit of silt which alters the germination rates.

The loss of soil translates to financial losses to a producer. Increased erosion results in increased downstream sediment loads which affect water quality, riparian ecosystems, and the hydraulic conveyance capacity.

Wetlands and their associated ecosystems are also adversely affected as a result of increased sediment loads. The sedimentation process is increased within an agricultural watershed. This results in greatly accelerated 'infilling' of the wetlands and the overall degradation of the wetland functions.

The overall quality of downstream riparian habitats is lowered. There is also an adverse effect on downstream man-made water storage facilities. The increased silt loads result in an increased infilling which shortens the life span of a reservoir and affects its intended uses.

3.7.1.4 Salinity

The glacial deposits are the source of the salts that occur in the Upper Assiniboine River Basin. The glaciers pulverized huge masses of bedrock, rich in pyrite and carbonates, and exposed these materials to weathering and dissolution and leaching by groundwater flow. These processes have produced the magnesium and sodium sulfates that are common throughout the region in soils, wetlands and lakes (van der Kamp and Hayashi, 1998). Snowmelt and seepage leach these salts, carrying them into the local groundwater and as inflow into wetlands. As the water evaporates from a wetland, there is a further concentration of the salts within the wetland water.

Salinity becomes a problem when there is a high water table and salts are trans-located to the surface. Although harmless while below the root zone, salts concentrated at the surface prevent plant roots from absorbing water and nutrients. Land management practices that reduce water from reaching the water table in recharge areas in conjunction with those that limit upward movement of water in discharge areas help to minimize the effects of salinity (Saskatchewan Wetland Conservation Corporation, 1997).

The native perennial vegetation on the perimeter of a wetland prevents the salts from reaching the soil surface. If this border is disturbed by cultivation, the plant roots no longer act as a buffer. The water from within the wetland then moves through the soil profile carrying salts to the soil surface resulting in a 'bathtub ring' around the wetland.

Wetlands located in the upper reaches of a catchment area act as ground water recharge sites. This is primarily associated with localized, shallow groundwater systems. Wetlands in this situation provide the hydraulic head required to pump salts through the downslope soil profiles.

3.7.1.5 Climate

Over the last two decades, researchers have been warning that man's activities are affecting the earth's climate. Attention has been focused on such topics as 'global warming', 'greenhouse gases', and 'ozone layer thinning and damage'. Research is also implying that if global warming continues at its present rates the climate will be altered and significant regional impacts will result. One of the most sensitive regions will be the Great Plains, which is largely a semi-arid environment. Wetlands vary in characteristics with fluctuations in weather. Wetlands are much different in such parameters as size, permanency, water chemistry, plant composition and distribution, numbers and densities if compared during wet or dry cycles. Even moderate changes to a drier and warmer climate will have serious implications to the existence of wetlands on the Prairies.

Recently, efforts have been focused on the inverse relationship, that is, the role of wetlands in determining climate. At the Third Conference of the Parties to the United Nations' Framework on Climate Change held in Kyoto there was considerable debate on the issue of natural sources and sinks of carbon (Lum, 1997). The use of carbon sinks to offset carbon emissions and the establishment of a global trading system based on emissions was discussed. Wetlands are being considered as possible "carbon credits".

Biological metabolic processes that occur in wetlands produce green house gases such as methane, carbon dioxide and nitrous oxide. Methane is 20 times as effective as carbon dioxide in trapping solar energy; nitrous oxides are 200 times more efficient. King (1990) suggested that as much as 25 percent of atmospheric methane originates from wetlands. The production of greenhouse gases by wetlands has been suggested as being a significant contribution to global warming.

Although there are only a limited number of peat basins within the Study area there are many basins that are in transition between prairie wetlands and true peat basins. Peat basins act as carbon storage sites or sinks because of their anaerobic environments. Carbon materials are stored by rapid deposition. This results in 'tying up' carbon within the wetland and there is no decomposition and release of carbon dioxide.

Water enters the atmosphere directly by evaporation from the surface of wetlands and via evapotranspiration by wetland plants. This has not been found to be a major factor in affecting local precipitation but obviously contributes moisture to the water cycle and at some point results in precipitation.

Climate is the result of many complex interactions of such parameters as solar energy balance, wind, hydrology and topography. The net effects that wetlands within the Upper Assiniboine River Basin actually have on weather and climate remain unclear. Further research methods need to be developed before an adequate assessment of the relationship between wetlands and weather can be determined in the Basin.

3.7.1.6 Wild Forage

Wetlands are a valuable source of wild forage for livestock feed. The nutritional value of this forage which is high in fibre and minerals closely matches the nutritional requirements of cattle during the fall season. There are low dietary risks associated with wetland forage as a feed source. This forage promotes proper digestion because of its roughness and mineral content.

The typical sources of wild forage are shallow basins that go dry by late July. Edges of more permanent basins and riparian zones are also important sources of wild forage. In the Basin, the predominant plants are whitetop grass and marsh sedges, with whitetop being most used. The yield is normally about 4.5 tonnes per hectare. By managing the water levels of a wetland, a 'back flood' operation can double the yield and improve the quality and palatability of the grass similar to that of tame, fertilized grasses. Yields in this situation can exceed tame forage crops.

Slough hay is used primarily by mixed farming operations with fewer than fifty head of cattle. These operations use their best land for cereal production. Larger cattle operations generally avoid slough hay because of the variability of the supply and quality. Harvesting can be hard on equipment and can be time consuming.

In years of average precipitation, much of the accessible slough hay within the Basin is utilized. During drought years, wetlands are a very important source of hay and play a much more significant role in the livestock industry.

3.7.1.7 Stock Watering

Wetlands and their associated uplands are important to livestock as a watering source both directly and indirectly. One aspect is the relationship between wetlands and riparian zones and their ability to purify water. Livestock along waterways are provided better quality water if wetlands are maintained within the watershed and along the waterway. The base flow is extended by maintaining wetlands within the watershed. Where possible, producers will benefit by protecting the riparian zones by using off stream watering systems. These measures not only protect downstream receiving waters and the directly affected riparian zones, but also provide a source of clear water which is a benefit to the overall health of the livestock.

Wetlands may provide a direct source of water for livestock during drought cycles but generally wetlands and livestock are not compatible because of the potential damage by cattle to wetland vegetation and the ground surface. Livestock can be compatible with wetlands if the water is delivered to the cattle outside the wetland area by pumping water to a trough. In pastures, particularly those that have a large native grassland component, wetlands may provide important watering sources.

3.7.1.8 Wildlife Viewing

Recreational activities associated with wetlands include camping, wildlife viewing, sightseeing, boating, picnicking, and photography. These activities contribute a large amount of capital to local communities.

A survey conducted by Environment Canada in 1991 found that Saskatchewan residents annually spent $77 million directly on activities for non-consumptive wildlife-related recreation, including photography and viewing. Another study (Young and Associates 1990) estimated that Saskatchewan people annually spent 3.1 million user days to visit wetlands. This study also estimated about $15 million annual expenditures by Saskatchewan residents on wetland-related recreation. A significant portion of these days were non hunting activities. The Basin offers a wide array of wildlife habitats, with wetlands forming a major component, which provide recreational opportunities.

3.7.1.9 Consumptive Use

Many of the fish and wildlife species harvested within the Basin spend part of their life cycle in wetlands or other riparian habitats. Wetlands are used for breeding, foraging and concealment. The main consumptive activities are hunting and fishing. These activities generate a large number of recreation days and represent a significant economic impact from a regional perspective.

In the Basin (Manitoba and Saskatchewan) anglers spend approximately 150,000 angler-days per year harvesting 285,000 fish (mostly walleye, pike and perch). These numbers, obtained from angling census data, represent less than 3 percent of the totals for the two provinces. Three main water bodies are used for fishing; Fishing Lake, Good Spirit Lake and Lake of the Prairies.

A study by Environment Canada (1991) estimated that Saskatchewan residents spent $153 million annually on fishing related activities. An estimate for Manitoba was not included since it comprises a small part of the Study area.

This study estimated that $49 million annually were expended provincially by Saskatchewan residents pursuing hunting related activities. Waterfowl hunting accounted for 21 percent of the hunting activities with big game at 52 percent. White-tailed deer is the main big game species in the Basin. The estimated deer population of big game management zones 37 and 39 in Saskatchewan, which makes up 85 percent of the Saskatchewan portion of the Basin, was 17,000 based on 1994 population surveys. The five-year average annual harvest by residents is 4,177 deer which generated an average of 15,000 hunter days per year. Deer hunting by non-Saskatchewan residents in Wildlife Management Zone 48 in 1998 resulted in 114 hunters generating 550 hunter days (Wapple, 1999).

Moose and elk also occur in the Porcupine Forest along the northern edge of the Basin, southwest of Preeceville, Saskatchewan, and in the Beaver Hills near Parkerview, Saskatchewan. Population surveys in the vicinity of Duck Mountain Provincial Park in March of 1998 estimated that there were 307 moose (+/- 8%), and 217 elk (+/- 16%). Some moose and elk hunting is allowed in zones 37 and 48 (Wapple, 1999).

Trapping of fur bearers such as beaver, muskrat, mink, and raccoon is another consumptive use that is of significance within the Basin. In 1998, 147 trappers were active in wildlife management zones 37, 39 and 48 in Saskatchewan (Wapple, 1999). Other consumptive activities include commercial bait fish harvesting, limited private commercial fishing of 'coarse' fish, and taxidermy, which is a notable secondary service of the consumptive use of fish and wildlife.

3.7.1.10 Ecosystem Productivity

Wetlands are sites of high biological productivity and diversity and as such are very important in the recycling of nutrients. Wetlands recycle, mobilize and concentrate nutrients, which are essential to increased biological activity and productivity.

The wetlands and associated plant communities are prime habitat for invertebrates which form the base of a wide, complex food web. They are an integral part of the life cycle of hundreds of species of birds, mammals, fish, amphibians and reptiles. Wetlands are essential to the maintenance of biodiversity on the Prairies.

3.7.2 Agricultural Producers' Considerations

Since the beginning of settlement of the agricultural area in the Prairies drainage of wetlands and land clearing have been influenced by water legislation, drainage law, land use policies and agricultural subsidies and indirectly by a host of legal and economic instruments. Legislation was designed to foster agricultural development and develop roads and railways to accommodate the wave of settlement and move production to markets. Early legislation reflected attitudes toward drainage. Drainage developments proceeded on the assumption that land drainage was beneficial and unlikely to have impacts.

Wetlands provided the necessary forage for mixed farming operations that were prevalent on the prairies after settlement. There were many farmers with small land holdings attempting to sustain a living from the land. Bush and sloughs were an impediment and were altered or removed as was feasible at the time.

Decisions to drain wetlands are based upon the costs and benefits to the farmer. Negative impacts on the environment or downstream farmers are not generally part of that decision. Farmers have not had incentives to retain wetlands for habitat conservation or flood control. As a result, many wetlands have been drained that may not have been if all costs had been taken into account.

A conflict has evolved between the farmers who have wetlands and the public who value those wetlands. Farmers have borne the costs of conserving wetlands because no mechanism exists for society to pay for the benefit of the wetland to the environment. The surface water and associated wildlife are public resources, but the water is located on "private land". There is general agreement that in a regulatory environment individuals or groups can acquire the right to drain, but should be responsible for the cost of construction and resulting costs to society. The costs of drainage of wetlands and the downstream costs are difficult to quantify. As well, the social costs such as loss of wildlife habitat and biodiversity cannot be completely expressed in monetary terms. Better methods must be identified for measuring the value of wetlands to society if these factors are to be included in decision making (Percy 1993).

Agricultural producers identified the following benefits of draining wetlands and clearing bush:

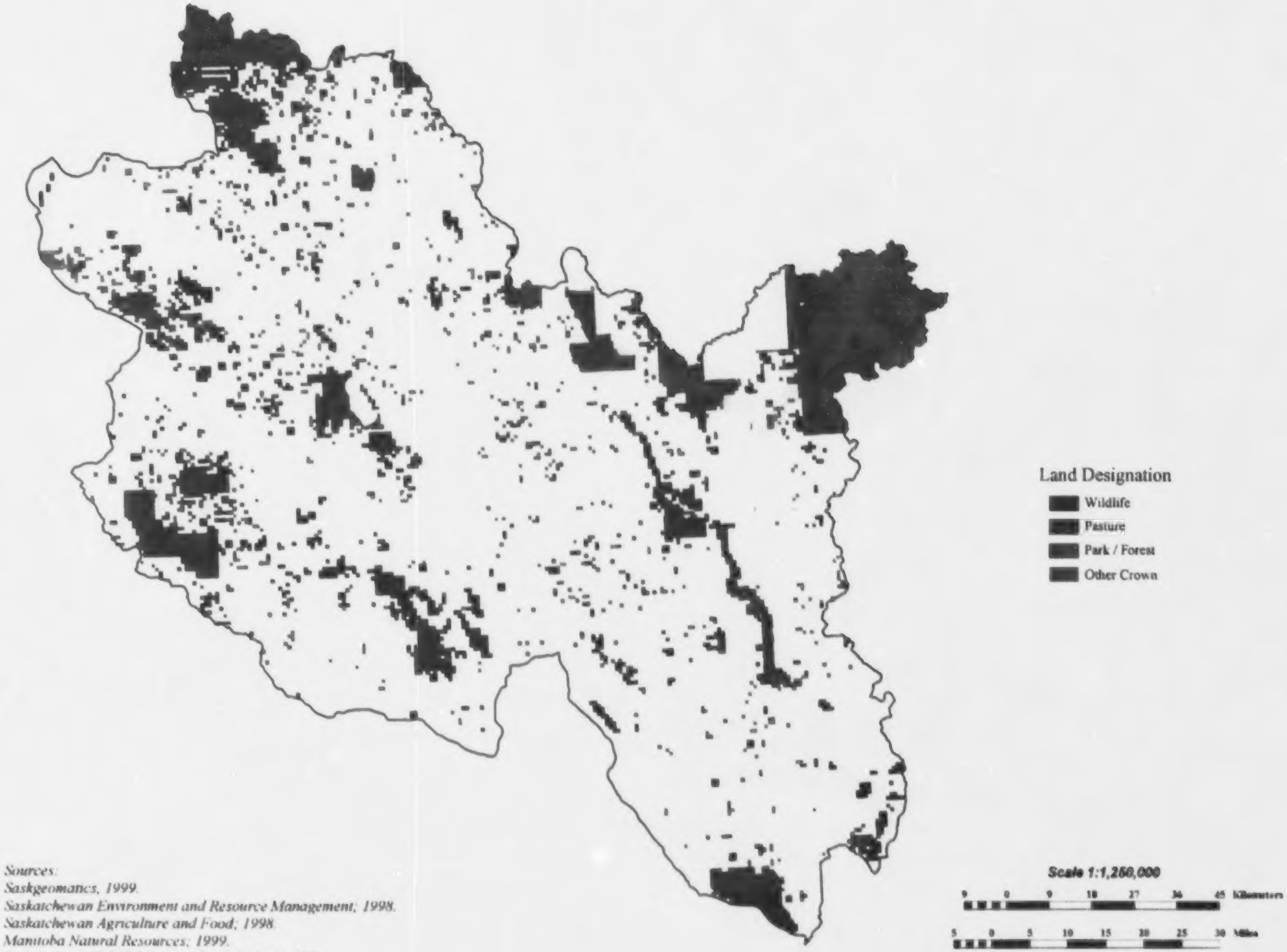
- Increased land area for production: Removal of bush and wetlands to increase land available for cultivation is often less costly than purchasing additional land.
- Improved land is a greater asset than unimproved land: Clearing and draining land increases the available acreage for cultivation and therefore adds value to the land.
- Increased efficiency: Removing wetlands and bush reduces the effort needed to farm around obstructions, reduces the over application of chemicals, reduces fuel costs, reduces salinity and weed problems adjacent to wetlands and reduces wear and tear on equipment.
- Improved crop management: Draining wetlands enables earlier seeding and thus earlier harvesting. This can also reduce the possibility of waterfowl crop depredation in the fall.
- Land development by clearing shrubs and trees and draining wetlands is perceived to be good farming and an acceptable cultural practice by the farming community.

Landowners see wetlands as a liability because no compensation is provided to landowners to retain the wetlands for conservation benefits.

3.7.3Land Tenure and Conservation Lands

Data were obtained on lands held under agreement which would have some measure of use for wildlife habitat conservation. These lands included federal, provincial and non-government lands. Table 3.14 summarizes the types of the conservation lands in the Basin. Figure 3.63 shows the distribution of these lands.

Figure 3.63
Conservation Lands in the UARB



Sources:
Saskgeomatics, 1999.
Saskatchewan Environment and Resource Management; 1998.
Saskatchewan Agriculture and Food; 1998.
Manitoba Natural Resources; 1999.
Prairie Farm Rehabilitation Administration; 1999.

Table 3.14 - Summary of Conservation Lands by Total Acres

Description	Hectares	Basin Percentage	Percentage of Protected Lands
Wildlife Lands			
Ducks Unlimited Canada	63,049	2.98	15.01
Manitoba	5,937	0.28	1.41
Saskatchewan	48,033	2.27	11.44
Total	117,020	5.54	27.86
Pastures			
Community Pasture - Federal	55,884	2.64	13.31
Community Pasture - Provincial	22,173	1.05	5.28
Total	78,057	3.69	18.58
Forest/Recreation			
Provincial Forest	26,133	1.24	6.22
Provincial Park	96,535	4.57	22.98
Total	122,668	5.80	29.21
Other Crown Lands			
Indian Reserve	19,546	0.92	4.65
Province of Manitoba	19,025	0.90	4.53
Province of Saskatchewan	63,695	3.01	15.17
Total	102,265	4.84	24.35
All Categories	420,010	19.87	N/A

The lands with some measure of protection of wildlife habitat occupy about 20 percent of the total land base in the Basin. There are pockets within the Basin where there is a concentration of conservation lands. This has occurred as part of overall strategies to secure habitat in areas where there is a high density of wetlands and native upland cover. Very few of the cultivated acres within the Basin have been affected by the habitat securement efforts of government and conservation agencies. Of these cultivated acres a very small portion could be considered as highly productive agricultural lands.

3.7.4 Waterfowl Depredation

Waterfowl are directly dependent on wetlands for both production of young and for staging areas during migration. Waterfowl, including geese, dabbling ducks and sandhill cranes, impact directly on crops by using agricultural produce for food. Spring grazing of newly seeded crops and fall depredation by local birds can be a problem. The majority of depredation and largest impacts on agricultural crops occur from fall migrating waterfowl staging on large water bodies.

To help producers with waterfowl depredation problems two similar programs exist in Manitoba and Saskatchewan. These programs, funded by the federal and provincial governments, compensate farmers for wildlife damage. A secondary goal is to foster positive farmer attitudes towards waterfowl and waterfowl habitat.

Studies have shown that the amount of damage to agricultural produce is directly related to the timing of harvest; the earlier the overall crop harvest the less the damage; the later the crop harvest the more the waterfowl damage. There is no significant correlation of damage to either general waterfowl populations or waterfowl habitat provided to local birds and the amount of damage to crops (pers. comm. A. Arsenault, SERM; Clarke *et al.* 1993). Figure 3.64 shows the number of bushels in compensation claims compared to the harvest date for 1987 to 1997. Figure 3.65 compares the amount of compensation paid to the time of harvest for 1987 to 1997.

3.7.4.1 Compensation Programs

(1) Saskatchewan

This provincial compensation program is administered by the Saskatchewan Crop Insurance Corporation (SCIC). The program is funded 50/50 by the province and the federal government and is a part of Saskatchewan's Agricultural Safety Net Allocation. All producers are eligible to claim compensation regardless if they have a crop insurance contract with SCIC. This program was implemented in 1978 based on the provincial and federal governments' commitment to the North American Waterfowl Management Plan (NAWMP). The initial program started with compensation at 80 percent of the assessed damage of the crops insurable by SCIC with a $500 deductible and was reduced to 70 percent in 1992 due to provincial budgetary constraints. In 1998 the program compensation was changed to 85 percent of the damage of the actual crop with a $200 deductible on each crop. Producers can file both a Crop Insurance production claim and a waterfowl damage claim but claims will not exceed the value of the entire crop (J. Kiss, Saskatchewan Crop Insurance Corporation, *pers. comm.*). Since inception the historic compensation payments have seen a high of $8 million from nearly 2,500 claims in 1996-97 to a low of less than $500,000 from fewer than 500 claims in 1981-82.

(2) Manitoba

The program is available to all farmers and is administered by the Manitoba Crop Insurance Corporation (MCIC). The formula for calculating compensation payments has varied over the years and has been based on guidelines set forth in the agreement negotiated with Canada. Before 1990, compensation payments approximated 50 percent of the value of the crop loss. Between 1990 and 1995, the compensation rate was increased to 80 percent of the value of the crop loss and in 1996 this rate was increased to 100 percent. The program has no deductible and no minimum or maximum payment.

Figure 3.64
Waterfowl Damage Compared to Harvest Date

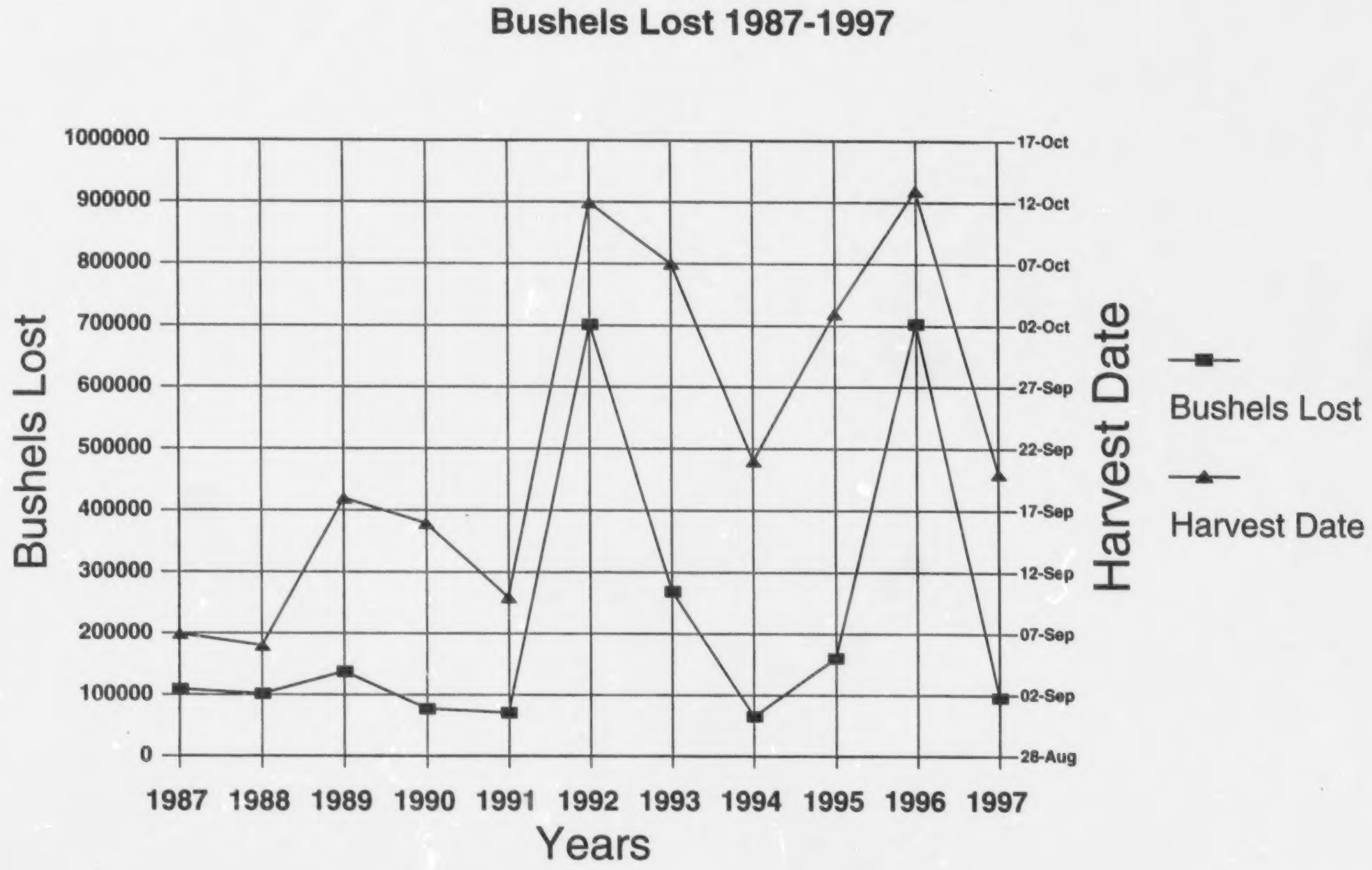
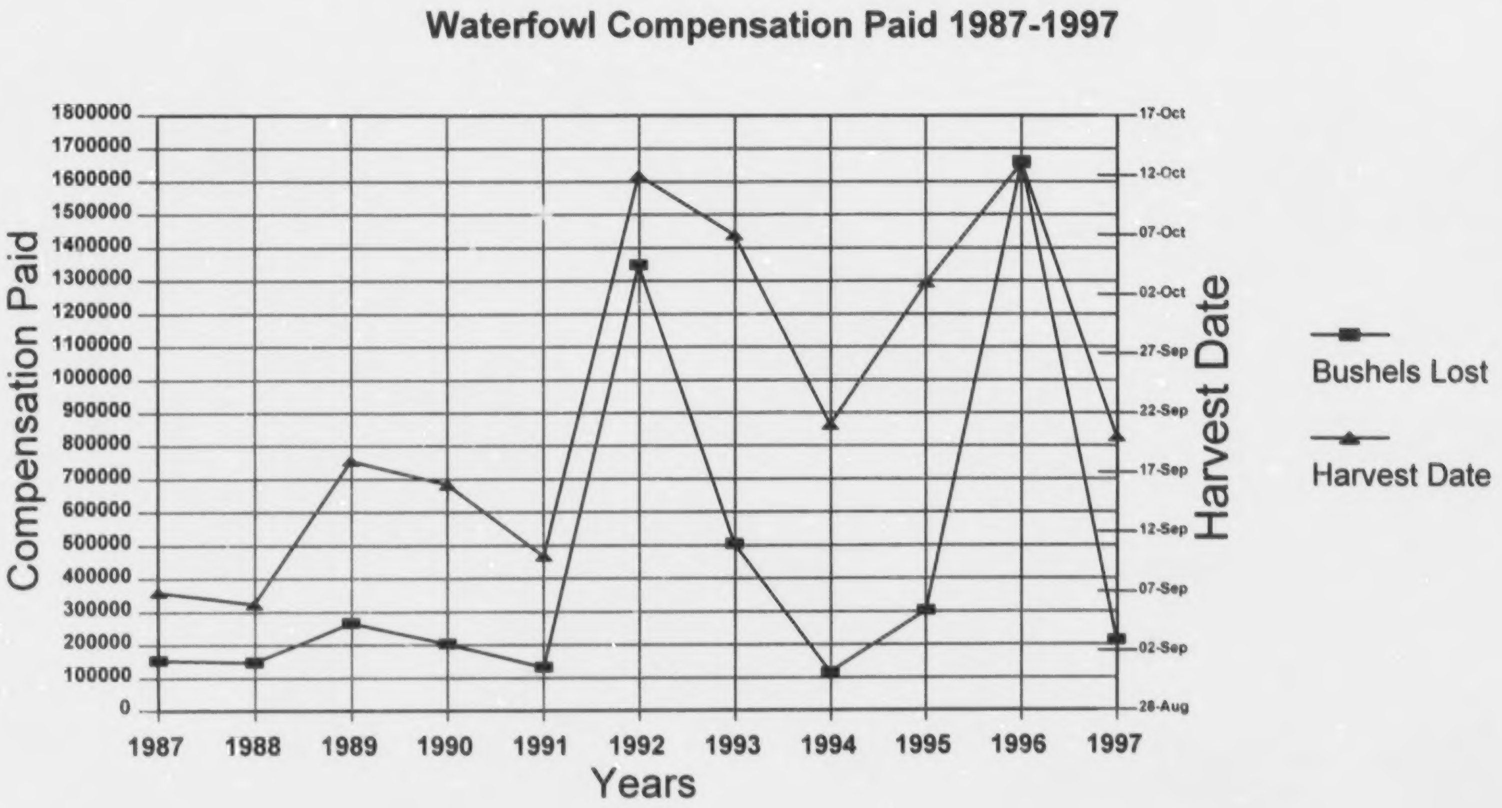


Figure 3.65
Waterfowl Compensation Compared to Harvest Date



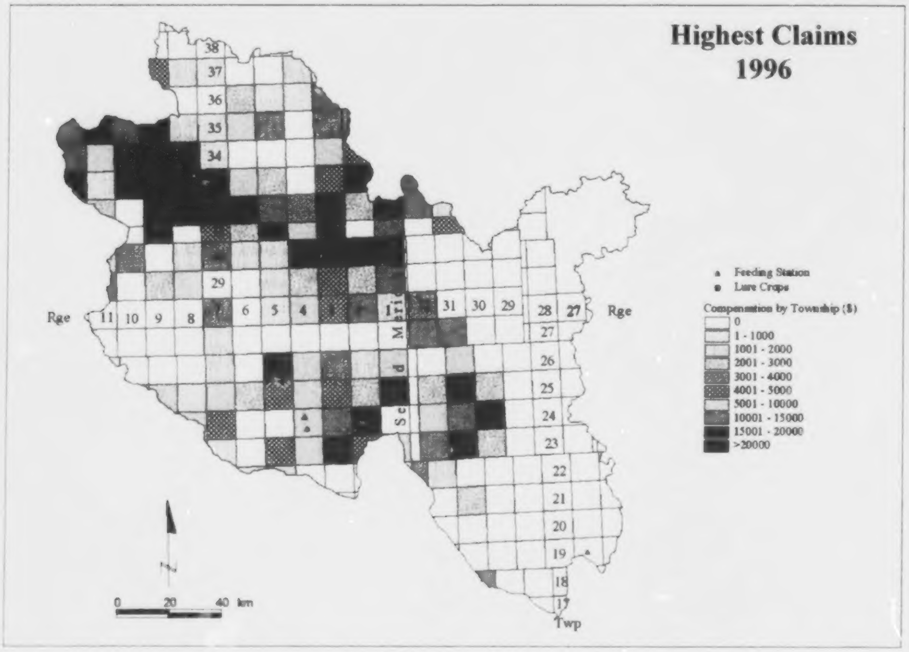
Annual expenditures depend largely upon harvest conditions. In wet falls, crops are more vulnerable to damage and program costs increase. In years of delayed harvest, program costs have exceeded $1.2 million, while in favorable years costs have been less than $200,000.

In the Study area annual compensation program costs have generally followed the trend in the rest of the province and varied from year to year depending on the timing of the harvest.

The maps in Figure 3.66 show the total compensation payment by township in the years with highest claims (1996), lowest claims (1994) and the average compensation (1987-1997). Figure 3.67 shows the number of townships with damage claims from 1987 to 1997. Figure 3.68 shows the compensation paid in the Basin from 1987 to 1997.

Maps of compensation paid by township in the Basin from 1987 to1997 are in Appendix IV.

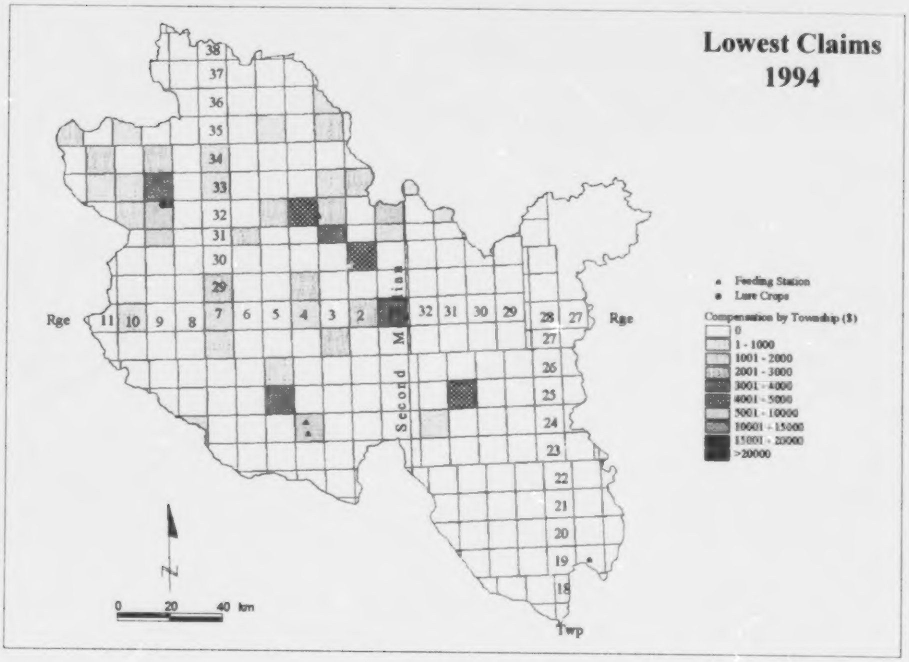
Figure 3.66
Waterfowl Damage Compensation by Township



Highest Claims 1996

continued on next page

Figure 3.66 - continued
Waterfowl Damage Compensation by Township



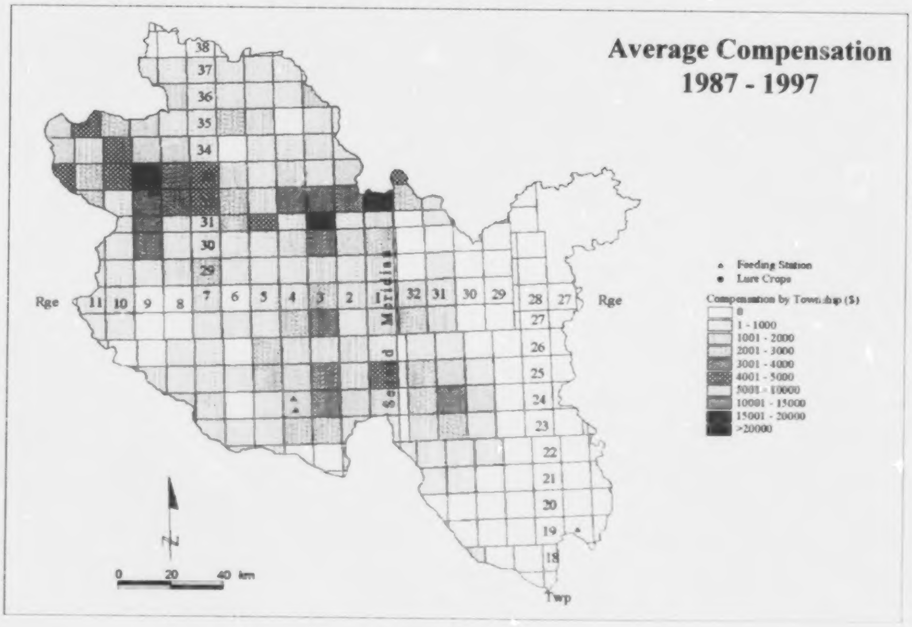


Figure 3.67
Number of Townships in the UARB with Damage Claims

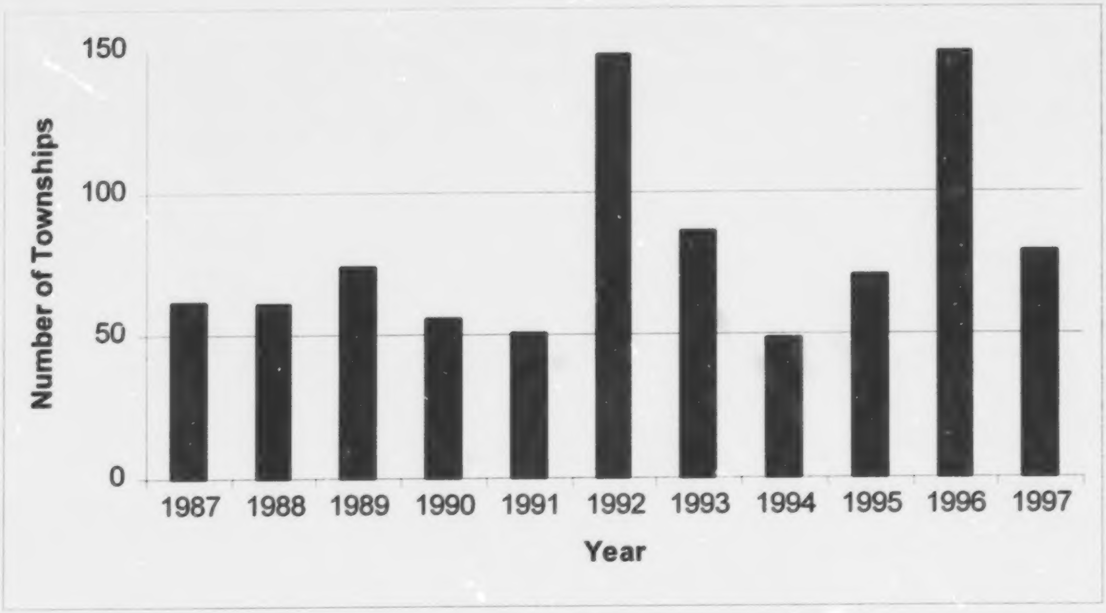
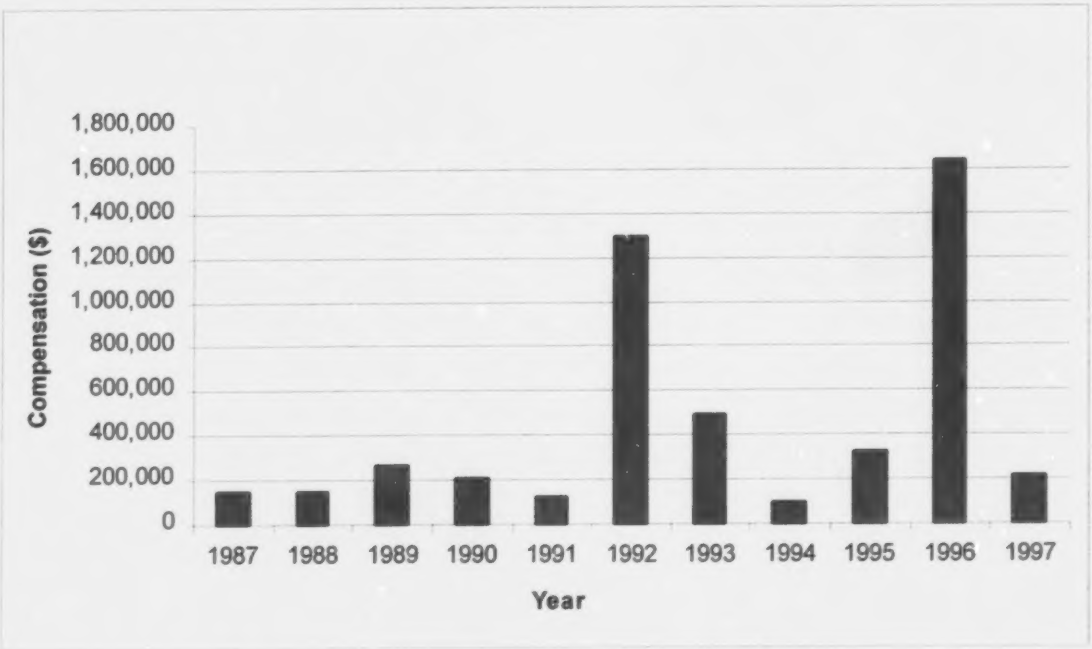


Figure 3.68
Waterfowl Damage Compensation in the UARB 1987-1997



3.7.4.2 Prevention Programs

Waterfowl depredation to field crops cannot be totally stopped but damage can be limited by various prevention methods. Crops are most susceptible to damage once they are swathed. The longer that the susceptible period coincides with the peak of the fall migration, the more significant the amount of crop damage that may occur. Harvest date and therefore crop susceptibility has a direct relationship to precipitation in any one year (Arsenault 1996).

Permanent lure crops are established on land (private or crown owned) adjacent to large, traditional waterfowl staging areas. These crops are planted solely to lure waterfowl and thus prevent ducks and geese from dispersing to neighboring farmers' crops. This is very effective in attracting geese but only somewhat effective in luring field feeding ducks (mallards and pintails) and sandhill cranes. A temporary lure crop is one purchased from a producer when waterfowl have already established a feeding pattern and damage to the crop is extensive. Temporary and permanent lure crops prevent damage by attracting waterfowl that would likely cause damage to unharvested, adjacent crops.

Feeding stations are located on major wetlands where large numbers of dabbling ducks (mallards, pintails, etc.) stage for fall migration. Barley is placed on a feeding pad daily and ducks tend to eat at this site rather than flying out to adjacent fields to eat. Feeding stations are very effective with ducks but very limited for reducing geese or sandhill crane depredation.

(1) Saskatchewan

In Saskatchewan the waterfowl damage prevention program is administered by Saskatchewan Environment and Resource Management. This prevention program annually operates feeding stations, lure crops, and temporary lure crops, and assists landowners by providing scare cannons and advice on waterfowl scaring techniques. Prevention activities and budget dollars are prioritized on a provincial basis and have generally been focused on areas of high damage where prevention is thought to be cost effective.

Provincial program expenditures have been at a high of almost one million dollars in 1985-86 and 86-87 and a low of $370,000 in 1981-82. More recently provincial program expenditures during the high depredation year of 1995-96 were $706,000 and in the low depredation years of 1996-97 and 1997-98 expenditures were $370,000. In 1995-96, $197,000 were spent on feeding stations, $171,000 on permanent lure crops, $61,000 on temporary lure crops, and $48,000 on scaring devices.

Part of the Basin is contained within a Public Advisory Committee (PAC) on Waterfowl Damage Prevention. This PAC has 10 rural municipalities and encompasses three RMs (Sasman, Invermay, and Foam Lake) within the Basin. Within the PAC there are 10 feeding stations (six are presently active), seven permanent lure crops (six are presently active) and an annual operating budget of approximately $180,000.

The PAC consists of representatives of local RMs, Ducks Unlimited, Sask Wildlife Federation, SCIC and local conservation officers who lead prevention efforts in the PAC area. The PAC has entered into partnerships with DU to provide scare cannons at a more affordable price for producers and is continually making recommendations to improve the program.

The PAC annually provides direction on prevention target areas for upcoming depredation seasons based on public feedback and compensation data, lure crop operations, waterfowl season dates and bag limits and new initiatives.

One new initiative is harvested temporary lure crops (HTLC) which have been very cost effective in limiting damage without major expenditures of money. Harvested temporary lure crops are fields which have already been harvested and waterfowl feed on residual grain left in the field. Rather than having hunters hunt and scare waterfowl from these fields to unharvested land nearby and causing damage, the landowner agrees to the field being posted "Lure Crop - No Hunting" and not allow hunting. This method has been shown to be particularly effective and efficient as no money is required to be paid for the posted field. These harvested temporary lure crops have not caused any concerns regarding the lack of available hunting land but are presently used only within the PAC area. These HTLC are usually early harvested crops such as field peas and winter wheat or fall rye and are especially effective for geese and sandhill cranes.

Scare cannons (propane fueled "bangers") in combination with scare crows, harassment by firearms or vehicle (under authorization by a Migratory Bird Scaring permit issued by local SERM office or RCMP detachment) are also effective methods in limiting waterfowl depredation on unharvested crops.

More than 400 scare cannons are available on a loan basis from conservation officers at Yorkton, Melville and Preeceville within the Basin and at Madge Lake, Wadena and Moosomin in close proximity to the Basin. Officers also provide information on limiting the damage and on the Waterfowl Damage Compensation program. Migratory Bird Kill Permits are available in extreme circumstances but the PAC has agreed that they are ineffective at limiting damage and only provide some short time satisfaction to the producer.

Within the Saskatchewan Study area in 1995-96 there were four feeding stations (two are currently active) which spent approximately $24,000, three lure crops (two are active) which spent approximately $5,500, and one temporary lure crop which spent $3,000. Overall expenditures in 1995-96 exceeded $32,500. Expenditures shift to areas of need in any given year. Therefore actual expenditures vary from year to year.

(2) Manitoba

The Manitoba prevention program annually operates feeding stations, Crown land and private land lure crops and assists landowners in scaring waterfowl from unharvested crops. Program efforts are prioritized on a provincial basis and have generally focused on areas where damage compensation pay-outs and numbers of complaints of damage have been high. These areas are most often farmland near large waterfowl staging marshes.

In the Upper Assiniboine area, the program annually operates one feeding station at Lidcliff Marsh and scaring equipment depots at Foxwarren, Angusville, and at the Manitoba Conservation District offices at Virden, Shoal Lake and Roblin.

Program expenditures largely depend on the weather during the fall harvest period. In years of delayed harvest due to a wet fall, the program has spent more than $630,000 while in years of an early harvest expenses have been under $320,000. Since 1996, the program's budget has been capped at approximately $350,000.

The feeding station operates from mid July until approximately 80 percent of the cereal crop is harvested in the area. Approximately 2,000 bushels of barley are fed in an average season. During the peak of operations, the station has fed as many as 20,000 ducks daily. Annual operating costs for the feeding station are $5,000 to $15,000.

At the scaring equipment depots, farmers can pick up propane scare bangers, propane tanks and scarecrows for deployment in their unharvested crops. As a cost saving measure in 1996, the program initiated farmer self-help waterfowl scaring and, since that time, has required farmers to become responsible for erecting scaring equipment on their fields. In the Study area, Manitoba Conservation District costs for providing prevention program services have ranged from $5,000 to $20,000 annually.

3.7.5 Management of Wetland Resources

The Wetlands Committee compiled information on the current policies, legislation and programs related to wetland management. This information is contained in Appendix V. Following is an overview of the history and development of wetland policy.

Canada is the custodian of a major portion of the world's wetland resource. Wetlands are one of the key life support systems on this planet, in concert with agricultural lands and forests. Wetlands are among the most threatened of Canada's ecosystems. Public attitudes have changed and Canadians have recognized and responded to this problem. Over the past 15 years, government, business, the agriculture community, and interest groups have become more concerned about protecting wetlands from impacts of developments, and about restoring or replacing wetland functions. These concerns have motivated considerable work on wetlands policy in Canada in areas such as identifying valuable wetlands and in scientific contributions to understanding of wetlands. The federal government and four provincial governments, including Saskatchewan and Manitoba, have introduced and implemented policy focused on wetland conservation. These policies recognize landowner rights and the need for cooperation of industry, business, conservation organizations and the public in protecting wetlands.

Much of policy discussion relating to wetlands centres around attempts to resolve the fundamental tension between the social benefits and private costs associated with wetlands on agricultural lands. Public benefits of wetlands include water storage, fish and wildlife habitat, nutrient assimilation, and sediment entrapment. The costs borne by the private landowner include the nuisance cost of farming around wetlands and the foregone opportunity to increase agricultural production. Guiding principles in policy discussion and development have attempted to balance the public benefits and private costs associated with prairie wetlands.

Federal, provincial, and municipal governments in Canada have the authority to make laws that affect wetlands. The authority over wetlands lies mainly with the provinces by virtue of their ownership of the natural resources that lie within their boundaries. The provinces have lead jurisdiction in conserving and managing wildlife and habitat. Policy action may manifest itself in a variety of forms including legislation providing governments with authority to act, regulations pursuant to that authority, operational policy statements guiding the application of legislation and regulations, and programs delivered with public funds.

Municipal governments also have authority which can affect wetlands. Municipal planning acts control land use and development. At this jurisdictional level many decisions regarding wetlands in urban and rural areas are made. Municipal planning, zoning, land acquisition, bylaws, and environmentally sensitive areas statutes can all have an impact on wetland protection. A few municipalities in prairie Canada have introduced municipal tax rebates for conservation land uses, not including wetland retention, on a pilot basis. In Manitoba, for example, the portion of each parcel's assessment that relates to wetlands and native cover areas is identified separately on assessment forms for the purpose of communicating their lower assessment and tax burden to the landowner.

At the time of settlement of the Prairies early drainage legislation supported the general attitudes towards drainage that prevailed during the early phases of agricultural development. It was based on the assumption that land drainage was beneficial and unlikely to have adverse effects. It created an incentive for large scale communal drainage through the formation of drainage districts. This was the precursor to later legislation which allowed the creation of Conservation and Development areas in Saskatchewan. As a local government an elected authority could promote, construct, operate and maintain drainage and flood control works for the benefit of agricultural land. Sporadically, with some partnering, multi-purpose works to benefit wildlife were incorporated. *The Watershed Associations Act* (Saskatchewan) was introduced to bring together voluntary member agencies to tackle issues and problems of common and sometimes conflicting interest on a watershed basis. In addition to water development projects, a watershed association has the legislated authority to pursue conservation, and protection of land, forests, recreational resources, and fish and wildlife habitat. Manitoba legislated *The Conservation Districts Act* to provide for the conservation, control and prudent use of resources. This framework provides for rural municipalities to voluntarily work together to deliver programs to address soil conservation, water management and storage, and land drainage. The structure and operational successes of the Manitoba Conservation Districts is positively viewed as a suitable template for local governments to address soil, water, and wetland issues on a watershed basis.

The last decade has seen a stronger legal foundation for stewardship activities. The federal government amended the *Income Tax Act of Canada* in 1996 to facilitate donation of ecologically sensitive lands, easements, and covenants to municipal, Crown and non-government environmental organizations. Provinces are promoting voluntary non-regulatory wetland conservation programs through conservation legislation, which permits establishment of stewardship programs, conservation easements and conservation covenants. Many of the difficulties encountered in protecting wetlands on private lands are most easily overcome by programs under which various organizations acquire valuable wetlands or enter into management agreements with the landowners. At the local level, municipal planning acts are also being used more effectively to promote stewardship programs.

Conservation organizations, whether they be national in scope or local lake and watershed stewardship groups, all share a common thread by being dedicated to preserving biodiversity to provide a healthy environment for wildlife and people now and in the future. These non profit, non-government organizations are collectively committed to the wise use and management of our resources in a manner that makes economic sense. Ecologically significant areas have been acquired and protected through purchase, donations, agreements, stewardship, and monitoring. These accomplishments have been achieved through partnerships among individuals, community groups, corporations, foundations, and governments.

Further development of cooperative, multiagency approaches, including the meaningful involvement of non-government organizations and partnering relationships is proving to be an effective means for managing and securing wetland and upland habitat for wildlife.

4 Conclusions and Recommendations

4.1 Status of Wetland and Upland Habitat

4.1.1 Types of Habitats

4.1.1.1 Wetlands

Wetland types are classified by the permanency of the water they contain, and the type of vegetation present under different moisture conditions.

Basin wetlands are discrete depressions (e.g., sloughs or potholes). There are five different types of basin wetlands based on water depth and permanency. Temporary wetlands are usually small, shallow depressions which usually become dry by the end of May. They contain fine-stemmed grasses and sedges and a wide variety of herbaceous plants. Seasonal wetlands are somewhat deeper, and usually larger, and retain water until late July. Coarse grasses and sedges, and taller herbaceous plants occur in these basins. Semi-permanent wetlands retain some water until freeze-up in most years. They are usually larger and contain a mosaic of open water and coarse emergent vegetation (e.g., cattails or bulrushes). Permanent wetlands contain surface water throughout the year except after periods of prolonged drought. They usually have a large central area of open water, and are often rimmed with a band of coarse emergent vegetation. Within the Upper Assiniboine River Basin (UARB) the most common basin wetlands are temporary wetlands (33%) and seasonal wetlands (53%). However, many of the seasonal wetlands may be dry in years with poor surface runoff in the spring.

Other wetlands include artificial wetlands (e.g., dugouts, stockponds along drainages, borrow pits from road construction) which usually contain water throughout the year, and have variable vegetation cover along their shorelines. Riparian wetlands include the courses of streams and rivers, and the vegetation along their shorelines. Some smaller streams may have intermittent flow of water, with all or portions of the stream drying late in summer and in drought conditions. Larger streams may have water flowing throughout the year. Shoreline vegetation can include wetland vegetation (e.g., grasses and sedges, coarse emergent vegetation), shrubs or trees. Lakes are large, permanent bodies of water which may have some reduction of water levels in drought periods but always retain water. Shorelines may vary from beaches of sand, gravel or rock cobble to emergent vegetation or grasses and sedges.

4.1.1.2 Uplands

Upland habitats include terrestrial communities adjacent to and distant from wetland habitat. They include altered landscapes (agricultural areas) and undisturbed or somewhat modified landscapes (areas of native vegetation). Native vegetation includes a variety of types of grassland, shrubs in more moist areas, and woodlands. Agricultural habitats include crops and tame forage.

The most notable characteristic of the upland vegetation is the presence of a broad range of plant species. This is due to the location of the Basin in the transition between prairie and boreal forest, and the variations in elevations along streams and rivers. Deciduous trees such as trembling aspen, balsam poplar, Manitoba maple and white birch dominate woodlands in the Basin. Many species of shrubs and herbs are found in the understory. Dominant tree species in the mixed woodlands are white spruce, trembling aspen. balsam poplar and white birch. Black spruce, tamarack, balsam fir and jack pine may also occur. Mixed woodlands provide the greatest diversity for breeding bird species. Small stands of deciduous trees mainly composed of trembling aspen and willow are typically found in the areas of intensive agriculture in the southern portion of the basin. Grasslands, found mainly in uncultivated pastures and along valleys and tree groves, are dominated by blue grama, speargrass, little bluestem, June grass and wheat grasses. The many types of vegetation in the Basin provide for a diversity of wildlife breeding and foraging habitats.

4.1.2 Areal Extent and Distribution of Habitats

4.1.2.1 Wetlands

Numbers, and area of wetland habitat, with surface water can vary significantly among years. In dry springs many wetlands will be dry or will hold surface water very briefly. In wet springs, with significant run-off from snow melt, most or all wetland depressions will hold water in the early spring, and many will retain surface water for a longer time.

The estimated number of wetland basins within the Basin with surface water in early May has varied from approximately 350,000 in drier springs, to approximately 700,000 in wet springs (CWS/USFWS aerial surveys).

According to LANDSAT satellite imagery (1994), wetlands and lakes account for approximately 5 percent and 1 percent of the land base within the Basin, respectively. The distribution of wetlands is not uniform. High wetland densities, with a wide diversity of wetland types, characterize some regions while other regions have relatively few wetland basins. The reasons for differences in wetland distribution are historically related to topography, slope aspect, local climate and soil characteristics such as water retention capacity, which influenced wetland development over time. Since settlement, human activities have affected wetland distribution in a relatively short time frame through activities such as land drainage and wetland consolidation. LANDSAT imagery classified wetland acres into five categories: open water, deep marsh, shallow marsh, wet/dry marsh, mud flat. These categories encompassed about 250,000 hectares which represent about 12 percent of the Basin area.

The distribution of wetlands varies throughout the Basin. Relatively fewer wetlands occur in the northwest portions of the Basin between Buchanan and Fishing Lake, in the northern portion of the Basin just north of Sturgis, and in some areas immediately east of Lake of the Prairies. Greater numbers of wetlands occur in the areas along the northern edge of the Basin, south of Yorkton, and from Wroxton to the southern edge of the Basin.

4.1.2.2 Uplands

Within the Basin the most abundant upland land cover is cropland (69%), followed by woodland (13%), native grassland (8%) and native grassland used for pasture (7%). Hayland is relatively uncommon (3%). The distribution of native vegetation (e.g., native grassland, shrubs and woodland) varies. Significant areas of wooded vegetation occur along the Assiniboine River valley, along the shores of the Lake of the Prairies, along the southern fringe of the Duck Mountains, in the forest fringe along the northern portion of the Basin north and west of Lady Lake, and in the region between Good Spirit Lake and Fishing Lake. Aspen groves are found throughout the Basin. Larger areas of native grasslands and shrubs are located in the western part of the Basin in the Beaver Hills and along the Whitesand River.

4.2 Importance of Wetland and Upland Habitat

4.2.1 Wetland Use by Wildlife

4.2.1.1 Wetlands

Individual wetland types, and complexes of wetlands of different types, are all important to wildlife during one or more aspects of their life cycles. The importance of individual wetlands must be assessed in the context of its neighbouring wetland and upland habitats.

Although temporary basins are often dry by early May, they provide foraging habitat for migrating waterbirds, and are an important stimulus for nesting by many species. They also provide "behavioural" habitat by providing resting sites as part of the territories of many species of waterbirds (e.g., ducks). When surface water disappears, these wetlands provide nesting cover for a variety of ground-nesting songbirds and small mammals, and foraging habitat for many species of larger mammals.

Seasonal wetlands contain surface water until mid-July in years of good spring runoff and precipitation. They provide important foraging habitat for many species of water birds which feed upon a variety of seeds of plants and many species of aquatic invertebrates which can be very abundant. They also provide brood-rearing habitat for many species of ducks which may hatch their clutches early in the spring.

The semi-permanent and permanent wetlands provide important long-term water supply for many species of wildlife during the spring to fall period. They provide brood-rearing habitat for water birds which nest later, or have longer development periods for their young. The greater diversity of vegetation within and along their shorelines results in a greater diversity of species of wildlife using these wetlands for breeding and foraging.

Artificial wetlands such as dugouts can provide important sources of water for larger mammals, provide brood-rearing habitat for waterfowl and other water birds during periods of drought, and provide habitat which allows metamorphosis of amphibians during dry periods.

Riparian habitat along streams and rivers is extremely productive for wildlife because of the complex diversity of vegetation which parallels the waterways. Mixtures of wetland vegetation, grassland, shrubs and trees provide a variety of habitat for birds, mammals, amphibians and reptiles. These habitats also provide important corridors for movements of wildlife within a given region.

Lakes provide an important habitat for those species which forage upon fish, or require more isolated sites for breeding (e.g., nesting islands).

4.2.1.2 Uplands

Woodlands provide habitat for a wide variety of birds and mammals. Different species use different portions of the woodlands for their breeding and foraging (e.g., ground, tall shrubs, lower branches, upper branches), and some species are able to use many areas of the woodlands.

Shrublands are an important component of the structural variation of habitat within woodlands, are often scattered within grasslands where they provide habitat for nesting or foraging or breeding activity (e.g., calling perches), and they are important habitat along the edges of wetlands.

Grassland habitat provides nesting and foraging cover for many species of birds and mammals. A high frequency and intensity of grazing can reduce the quality of grassland habitat for some species of wildlife, and improve the quality of the habitat for other species.

Cropland is a monoculture of vegetation which generally provides limited habitat for wildlife. A few species may utilize cropland when it is fallow or in stubble, and others (e.g., waterfowl) will utilized cropland for foraging in the fall. Tame forage can provide more breeding and foraging habitat for wildlife, but this upland habitat is also relatively uniform in structure and relatively few species utilize it for breeding. Removal of hay crops can often result in mortality of ground-nesting wildlife and their eggs or young.

4.2.2 Endangered, Threatened and Rare Species

The Basin does not appear to be an important area for endangered, threatened or rare species of wildlife in prairie Canada. Migrant whooping cranes and piping plovers may occasionally pass through the Basin. There may be some nesting by loggerhead shrikes, burrowing owls and ferruginous hawks but numbers are likely extremely low. The short-eared owl can be abundant in some years when small mammal populations are high. The northern leopard frog has declined in recent decades, but may now be increasing in numbers along major waterways. The monarch butterfly may occur throughout the Basin. The 31 rare plants listed for Saskatchewan have not been found within the Basin.

4.2.3 Feature Wildlife Species

Several species of wildlife, which are vulnerable because of their localized breeding distribution, occur within the Basin. These include the black-crowned night heron, American bittern, sandhill crane, yellow rail, Franklin's gull, common tern, Forster's tern, and black tern which utilize wetlands and lakes for breeding and foraging. The yellow-throated vireo and golden-winged warbler may occur in small numbers in woodlands in the eastern portion of the Basin. The red-sided garter snake may occur along the major waterways and forage in riparian habitat and adjacent wetlands.

4.2.4 Waterfowl

The Basin is an important breeding area for waterfowl in prairie Canada. The diversity of wetlands types, abundance of more permanent wetlands, and more stable water conditions compared to more southerly regions, allow for more consistent waterfowl production. Seven species of dabbling ducks breed within the Basin. The mallard and blue-winged teal are most abundant. Seven species of diving ducks breed within the Basin. The lesser scaup, canvasback, redhead and ruddy ducks are the most abundant. Dabbling ducks are much more abundant than diving ducks. Total ducks within the Basin varied from approximately 200,000 in the dry late 1980s to over 800,000 in the late 1970s when water conditions were good.

Signed in 1986, the North American Waterfowl Management Plan (NAWMP) is an international agreement between the federal governments of Canada, USA, and Mexico to restore and maintain continental waterfowl populations to the average levels observed in the 1970s. The means to accomplish this goal is through habitat protection, conservation and restoration, and through modification of agricultural practices to become more wildlife friendly while economically and agronomically beneficial for producers. NAWMP partners work together with private landowners, government and non-government conservation agencies, various members of the agricultural and resource industry sectors and the scientific community. Ducks Unlimited Canada (DU) was selected by the NAWMP to deliver the majority of the NAWMP program in Canada. Other NAWMP program agencies/partners include: Saskatchewan Wetlands Conservation Corporation, Environment Canada, Manitoba Habitat Heritage Corporation, Manitoba Conservation and Saskatchewan Environment and Resource Management. While waterfowl are the target species for much NAWMP activity, the mandate has broadened to include multi-species benefits. The benefits to society from habitat conservation are numerous and include water conservation and purification, biodiversity, and recreation opportunities.

The NAWMP has identified the prairie pothole region (PPR) of prairie Canada and the northern USA as the most important breeding habitat for waterfowl in North America. Breeding waterfowl are annually surveyed across western Canada by federal wildlife agencies of Canada and the USA to monitor population trends. DU has incorporated this data into a scientific model that predicts the potential distribution of breeding waterfowl in the Canadian Prairies. This analysis has confirmed the importance of the Basin within the Canadian PPR and to North America's waterfowl resource. The NAWMP has identified seven target regions or "delivery landscapes" within the Basin. NAWMP programs (Prairie CARE) are targeted at these landscapes but will also be available in desirable habitats outside of the target regions when warranted. These programs include: agriculture extension for cattle, forages, winter cereals, seed production; wetland restoration and development; lease or purchase of existing habitat; conservation easements; and restoration of grasslands.

4.3 Natural Fluctuations in Habitat

Wetland numbers, and their characteristics, vary over time in response to moisture conditions. The number of wetlands with surface water in the early spring can dramatically change in response to spring runoff after the snow melt. Wetlands also change over time as vegetation changes in response to moisture conditions. Under prolonged high water levels shoreline vegetation can die back and open water is dominant. Under low water levels, increasing amounts of wetland vegetation grow. After prolonged dry periods entire wetland basins may be filled with wetland vegetation. Upon return of higher water levels, the cycle begins again.

These changes in wetland habitat promote changes in their use by different species of wildlife. Some species disperse to other areas to breed, others remain but breed in adjacent but less secure habitats, and others do not breed but wait until suitable conditions return.

4.4 Change in Habitat Due to Land Use Change

During the settlement of the Prairies the landscape has changed dramatically. The predominant industry and land use within the Basin continues to be agriculture. The agriculture industry faces competition from around the world. Farmers must be able to accommodate these world wide influences and react to this global economy to remain profitable. New agricultural technologies continue to make production more efficient. Although this is beneficial, it is not a complete solution. In an effort to succeed, the landowner must manage his/her land base to achieve its maximum agricultural potential. Factored into these decisions is the long term ability of the land to sustain production. Thus, it is not surprising to find that land use is constantly changing as conditions that may affect agriculture change.

Several sources were used to document the extent of change that has occurred in the Basin.

- Statistics Canada agricultural census data indicate that the average farm size in the Basin in 1956 was 404 acres. The rural population was about 57,000. By 1996, the rural population had decreased to 23,000 and the average farm size had increased to 854 acres. Land use had also experienced change. In 1956, 51 percent of the Basin was used for annual crop production and 44 percent of the Basin was reported as unimproved acres land which remained as native or not 'broken'. By 1996, annual crop production was occurring on 64 percent of the Basin and the unimproved acres had fallen to 24 percent.

- A study by Ducks Unlimited, in 1995, found that for an area near Yorkton, the average loss of wetlands was 45 percent. A second study by DU in 1999, confirmed wetland impacts cited in other literature, and also concluded that most change (to wetlands) had occurred prior to 1981 and that more recent drainage efforts by landowners were to improve existing drainage works.
- A Sask Water study in 1994 of a Township near Langenburg found that in 1957, 42 percent of the land was cultivated, wetlands occupied 16 percent and bush and uncultivated areas occupied 42 percent of the township. By 1989, the cultivated acres had risen to 79 percent, while wetlands had been reduced to 7 percent and unimproved acres had decreased to 14 percent.
- The Canadian Wildlife Service has also documented change in annual ground surveys of habitat transects conducted within the Basin. Along these transects most temporary wetlands are cultivated and the margins of semipermanent and permanent sloughs are highly disturbed.

Other factors were associated with land use change in the Basin.

- Natural stream or river corridors are often the only wildlife habitat remaining in an area and are extremely important for wildlife survival. Encroachment by agriculture has led to a land use conflict due to increased flood susceptibility. Channel clearing is a measure adopted to improve stream hydraulics. As well, channelization of waterways can leave the remaining wetlands within the watershed more susceptible to further drainage. The upstream landowner may perceive that an adequate downstream outlet exists which may lead to increased drainage activity.
- Roadways, and to some extent railways, have altered the natural drainage patterns within the watershed. The roadway standards have improved with time, and their roadside drainage works have also been enhanced. Roadway ditches are being utilized as waterways and their presence has encouraged drainage of adjacent wetlands.

Agriculture policies have had a great impact on land use and agriculture practices within the Basin. The intent of most earlier agricultural programs was to enhance cultivated acreage farm income. These programs provided financial support to producers growing grains, oilseeds and more recently, specialty crops. By strengthening these crop sectors, support programs favoured cultivation over other land uses. In recent years, governments have moved to a 'whole farm' approach for income support programs. These more recent programs have little effect on land use decisions made by the agricultural sector. The adoption of environmentally friendly agriculture policies could have an enormous impact on the long term land use in the Basin.

4.5 Effects of Alteration and Loss of Wetlands on Wildlife

Many land use activities can impact on wetlands and their associated wildlife. Among these are burning, clearing, drainage, filling, grazing, haying, and road building. Each of these actions can have a major impact on wildlife, particularly when the wetland or upland habitat is irrevocably lost. Incremental loss of wetland habitat, wetland margins or upland grassland, shrub or tree cover has an impact on wildlife. This loss is almost impossible to measure or quantify in terms of the species affected and numbers of individuals displaced or lost. However, that the aggregate of all habitat losses within the Basin, as well as those upland and wetland habitats that have been permanently altered or fragmented, has resulted in less wildlife over the long term. The capability of the land base in many cases has been altered to the extent that no wildlife can be produced or live in those areas. There may be periodic increases of a species, e.g., white-tailed deer or Canada geese, but over the long term, the habitat capable of sustaining these and many other species is declining. The biodiversity of a landscape as diverse as the Basin can be measured by the abundance of wildlife species and their populations within the area. Wetland ecosystems contribute in large measure to the biodiversity of any area. As wetlands are lost or altered, the biodiversity of the region is ultimately affected incrementally. If the health of the landscape is indicated by its biological diversity, continued degradation and loss of wetlands will be an effective barometer.

4.6 Social and Economic Considerations Associated with Wetlands

Wetlands provide a number of hydrological and ecological functions as well as economic benefits. Prairie wetlands are of immeasurable ecological value because they provide habitat for many plant and animal species and because of the roles they play in water purification, flow stabilization, flood control, and in some situations groundwater recharging. Wetlands recycle, mobilize and concentrate nutrients, which are essential to increased biological activity and productivity. The wetlands and associated plant communities are prime habitat for invertebrates which form the base of a wide, complex food web. They are an integral part of the life cycle of hundreds of species of birds, mammals, fish, amphibians and reptiles. Wetlands are essential to the maintenance of biodiversity on the Prairies.

Wetlands provide areas for livestock watering and wild hay production, a source of domestic water, recreational activities, and consumptive uses such as hunting, trapping and fishing.

Although landowners are the recipients of some of these benefits they also regard wetlands as liabilities. Wetlands are viewed as a source of additional cultivated acres without purchasing additional land. Removing wetlands and bush reduces the effort needed to farm around obstructions, reduces the over application of chemicals, reduces fuel costs, reduces salinity and weed problems adjacent to wetlands. Draining wetlands enables earlier seeding and thus earlier harvesting. Migrating waterfowl and sandhill cranes feed on unharvested crops. Landowners see wetlands as a liability because no financial incentive is provided to landowners to retain the wetlands for conservation benefits.

4.7 Resolution of Land Use Conflicts between Agricultural and Environmental Protection Interests

Based on the analysis of the available information the Wetlands Committee proposes that the following principles be considered in managing wetland and upland habitat in the Basin.

1) The Upper Assiniboine River Basin provides important wildlife habitat in east central Saskatchewan and west central Manitoba.

2) All wetlands and upland native vegetation provide benefits for wildlife, and for soil conservation and water quality.

3) Retention of remaining wetland and upland habitats should be carefully considered in plans for rural and urban land development.

4) Agricultural interests in further land development should be recognized.

5) Agricultural and conservation interests should work together to identify land areas that can be further developed and those which can be retained, enhanced or restored for conservation purposes.

6) Approaches are needed to enable agricultural and conservation interests to work together to apply these principles.

4.8 Recommendations

The Wetlands Committee recommends the following strategies to assist in achieving agricultural and conservation interests.

Recommendation 1.

Watershed plans should be developed as a basis for designating lands for development and lands for conservation purposes.

Following are considerations for developing a watershed plan.

a) Organization and Administration: Various models to enable and support watershed planning have been discussed during the Study. Among the existing legislative mechanisms available are the watershed association and conservation area authority in Saskatchewan and the conservation district in Manitoba. Both provinces also have legislation that supports municipal land use planning that could be applied to a watershed plan. As well, new mechanisms could be developed to enable development and implementation of a watershed plan. Regardless of the mechanism used, the key factor in success will be the need for commitment from a broad range of stakeholders to participate in an organized, administrative body to develop and implement a watershed plan. Such an organization could have certain legislated authority to undertake development and conservation initiatives.

b) Participants: Preparation of a watershed plan must involve people who represent local landowner interests, municipal councils, existing local government associations which have projects in the watershed (e.g., conservation area authorities, watershed associations, conservation districts), and government and non-government agencies with water management, agricultural and wildlife resource interests.

c) Size of a watershed: The size of the watershed will reflect the interests in agricultural and other land development, problems identified, and willingness of stakeholders to participate in developing a watershed plan. The watershed must be large enough to bring together sufficient resources to develop and implement a plan.

d) Resources to develop a plan: Commitments would be needed from local and provincial government and non-government interests to dedicate resources to developing a plan. The results of the Upper Assiniboine River Basin Study provide considerable information to serve as planning tools to undertake development of a plan. This information should be accessed at the initiation of plan development.

e) Resources to implement a plan: Once a plan is developed, opportunities for implementing the plan can be identified. Some landowners may voluntarily participate in delivery of the watershed plan initiatives. Others may request compensation for retaining habitat. Government and non-government programs are a potential source of funds for undertaking conservation related initiatives. These organizations will be encouraged to participate in assisting with implementation of an agreed upon plan. Participation of a broad range of interests in developing a plan will provide the basis for greater interest in supporting plan implementation.

Recommendation 2.

A planning and approval process should be developed to support landowners and government resource management agencies in determining appropriate levels of development.

a) Implementation: Ideally, approval to drain wetlands and clear native riparian and upland habitat would be based on a watershed plan. Currently Manitoba and Saskatchewan legislation enables approval of drainage works on a case by case basis. There is no current mechanism other than the shoreland alteration permit to regulate removal of riparian habitat and other native upland habitat. This permit is also based on a case by case application and does not usually enable consideration of a larger area. Thus ongoing wetland drainage and clearing of upland habitat can result in a landscape with highly altered wetland basins and fragmented remnants of upland habitat that provide less than favourable conditions for supporting viable wildlife populations.

In Saskatchewan, an approval to drain wetlands is required if the water would leave the landowner's property. Approval is not required for drainage and consolidation of wetlands within a landowner's farm unit. In Manitoba, approval is required for on farm and off farm drainage. Mechanisms that could encourage and support conservation of wetlands and wildlife habitat in developments on farms are education, extension, and compensation programs. For off-farm development proposals, programs could include compensation, mitigation, and enforcement.

Recommendation 3.

Criteria should be developed to assist landowners in planning and resource managers in evaluating and approving proposed wetland drainage and upland habitat removal.

a) Classification of wetlands: Often resource managers are asked to classify and identify which wetlands can be drained and the level to which they can be drained. Because of the variability in landscape conditions, and the surrounding habitat complex, it is very difficult to provide a simple description of which wetlands can be modified with the least environmental effects. The importance and benefits of the full range of wetland types and riparian habitats, in a given local area and within the entire watershed planning area, need to be recognized in planning for and approving drainage plans. Each type of wetland is important to support a diversity of species. The temporary, seasonal and semi-permanent basins are as important as the more permanent basins and lakes. Planning for wetland drainage should recognize the importance of retaining a complex of wetlands with a variety of wetland habitats.

As specific land management plans are developed work would be needed to document remaining wetland and upland habitats and their importance in the watershed and region. This more detailed classification can be done at the smaller scale to provide direction.

b) Areas of conservation interest: Identification of environmentally sensitive areas is necessary as a basis for directing a variety of programs including compensation where off farm drainage is proposed. The results of the Wetlands Committee's work provide a basis for identifying wetland and upland habitats, and understanding the importance of these habitats. As specific plans are developed, additional work would be needed to document remaining wetland and upland habitats and their importance in the watershed and region. Similarly information is available on topography, hydrology, soils, and lands which have some level of conservation protection. Participants in developing a watershed plan can use this information to better develop an understanding of the resources, and to identify desired directions for development and conservation. The result would be a plan that would identify areas more suited for certain types of development and lands which would be deemed important for some level of conservation management.

c) Mitigation: A proposed plan for off farm drainage which impacts wetlands, or channelization in riparian habitats, should include mitigation. Mitigation may involve retaining, improving or restoring habitat to compensate for habitat that may be lost in developing a project that involves land drainage and/or clearing. Including mitigation in a land development plan would be applicable at a small scale (individual farm) or larger scale proposal (watershed level).

Recommendation 4.

One or more pilot projects to undertake watershed planning should be initiated as soon as possible.

a) Implementation: Two areas where there are different issues and land use interests could be selected for pilot projects. For example, one area could be the Lower Assiniboine River sub-basin where some landowners have expressed interest in undertaking considerable land development. A second pilot project could be initiated in an area where there are expressed interests in undertaking different land management, cropping practices and conservation measures. Areas for consideration are the Yorkton Creek watershed and the Upper Whitesand River area.

Recommendation 5.

Information and extension programs should be developed to increase awareness of the importance of wildlife habitat in the Basin as well as the opportunities to implement land use activities that will benefit both agriculture and wildlife.

a) Agricultural extension: Agricultural land management systems that support economic development and maintain wildlife habitat should be promoted. Some examples are alternative land use grazing systems, forage production and cultivation of crops that have economic potential, reduce soil erosion, and provide cover for nesting birds and other wildlife. Demonstration projects and field tours could be used to provide information on some of the opportunities and successes that exist in the region.

Interest and support for on-farm planning could be explored. Development of a plan by a landowner with assistance from agricultural and wildlife specialists could benefit the landowner and provide opportunities to protect wildlife habitat. An on-farm plan developed by a landowner could be used to encompass a broad range of environmental management measures that could provide assurance to the landowner that specific development practices are practical, sustainable and acceptable. This may assist the landowner in allaying the suspicion that environmental concerns will tend to override the landowner's interests.

b) Wildlife damage prevention and compensation: Landowners should be provided with information on wildlife damage compensation programs and prevention practices. Wildlife damage compensation programs are available in Manitoba and Saskatchewan. Activities should be undertaken to ensure that landowners are aware of available compensation programs and who to contact regarding damage claims. Information should be provided to landowners on prevention practices that could reduce the potential for crop loss and damage. Some of the practices which can reduce crop loss and damage are planting lure crops, posting harvested areas as "no hunting", feeding stations, and using scare cannons. Land management practices which can reduce the potential for crop damage and loss due to migrating birds are early spring or fall seeded crops which are harvested before migration, earlier harvesting of crops in proximity to staging areas, selecting crops that are less likely to be attractive, and straight combining to remove the attraction of swathed crops.

Organization of local public advisory committees to develop and promote local crop damage prevention programs should be considered. A local committee could provide an opportunity for landowners, municipal councils and others to identify and participate in planning and implementing waterfowl crop damage prevention programs. For example, a public advisory committee was formed in the Wadena-Quill lakes region on the western edge of the Basin. Some of the rural municipalities in the Basin have participated in this program and reported good experiences with it. Implementing similar public advisory committees in the Basin could be explored.

Recommendation 6.

Beaver management programs should be developed in watershed management planning areas.

a) Implementation: Provincial beaver management strategies are needed in Saskatchewan and Manitoba that identify a responsible agency and provide for adequate funding. Appropriate policy and legislation amendments may be required to support these strategies. Specific problem areas in the Basin could be identified in which local governments and resource management agencies would work together to target management efforts.

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Appendix I

Wildlife Utilization of the Upper Assiniboine River Basin (UARB)

Presence, Abundance and Value

by

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1.0 Introduction

Most of the Upper Assiniboine River Basin (UARB) lies within what is often called the prairie pothole region, a 750,000 km^2 area in the prairie and parkland regions of southern of Manitoba, Saskatchewan, Alberta, North Dakota, and South Dakota. The headwaters of the Assiniboine River form in the Mid-Boreal Upland Ecoregion (Acton, *et al.* 1998) northwest of Preeceville, Saskatchewan on the southern edge of the Porcupine Hills (Figure 1). The river flows southeast through a narrow portion of the Boreal Transition and Aspen Parkland Ecoregions (Acton, *et al.* 1998) and into southwestern Manitoba to the southern edge of the UARB at its confluence with the Qu'appelle River near St. Lazare, Manitoba, a distance of nearly 300 kilometres. Major tributaries include the Whitesand River which drains the northern slopes of the Touchwood Hills and joins the Assiniboine River near Kamsack, Saskatchewan, and the Shell River which drains the southern slopes of the Duck Mountain uplands, joining the Assiniboine near Shellmouth, Manitoba. There is also substantial drainage from the Porcupine Hills to the south into Fishing and Good Spirit Lakes (Acton, *et al.* 1998).

The UARB contains an exceptionally wide diversity of wildlife habitat that includes mixed-wood and deciduous forest, aspen parkland, steep wooded coulees, creeks, rivers, native grassland, and a variety of wetland types. This report will describe the physical characteristics of these habitats and provide examples of how wildlife species spatially and temporally utilize different habitat types.

1.1 Geological History

The Assiniboine River was formed between 14,000 and 12,500 years ago by meltwater from the retreating Wisconsin continental glacier (Christiansen 1979). The topography is gently to moderately rolling, with elevation varying from 426 metres in the lowland riparian corridors along the Assiniboine River to 685 metres in the Duck Mountain uplands in the northeast portion of the basin. The UARB lies in a till plain over marine shale bedrock of the Upper Cretaceous Riding Mountain Formation (Klassen 1979). The till of the valley slopes is composed of undifferentiated deposits, while that of the valley floor is composed of alluvial deposits (silt, sand, and gravel).

Acton *et al.* (1998) summarize other geological features of each ecoregion within the UARB (Figure 2). The Mid-Boreal Upland Ecoregion contains portions of the Duck Mountains, and the southern slopes of the Porcupine Hills, where the Assiniboine River originates. Duck Mountain is an Upper Cretaceous shale bedrock high covered with over 200 m of glacial drift and dark gray chernozemic soils are most common along the southern slopes of Duck Mountain that are encompassed by the UARB. The Porcupine Hills, underlain by Upper Cretaceous shale bedrock are dominated by gray luvisol soils with some dark gray

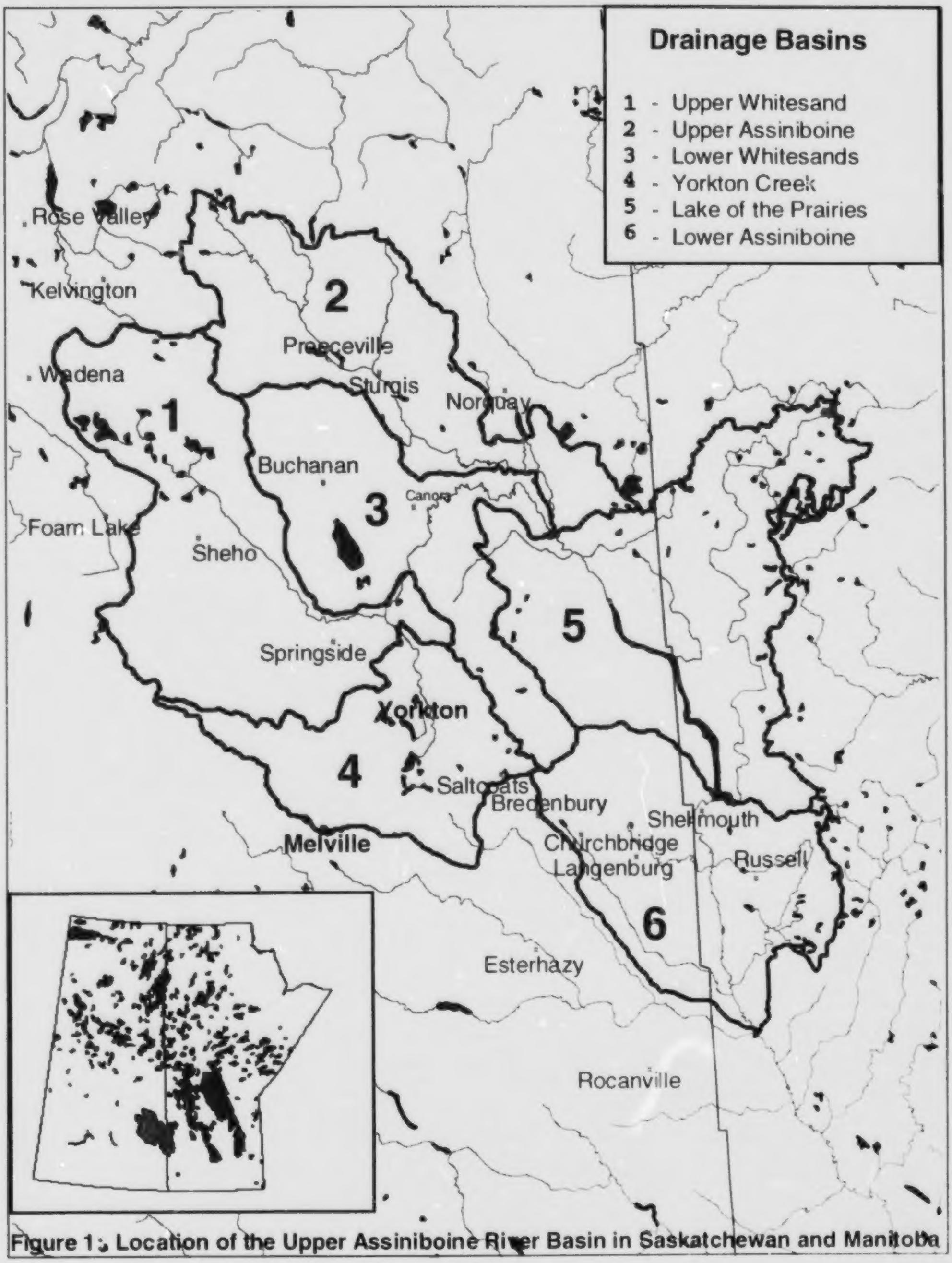


Figure 1: Location of the Upper Assiniboine River Basin in Saskatchewan and Manitoba

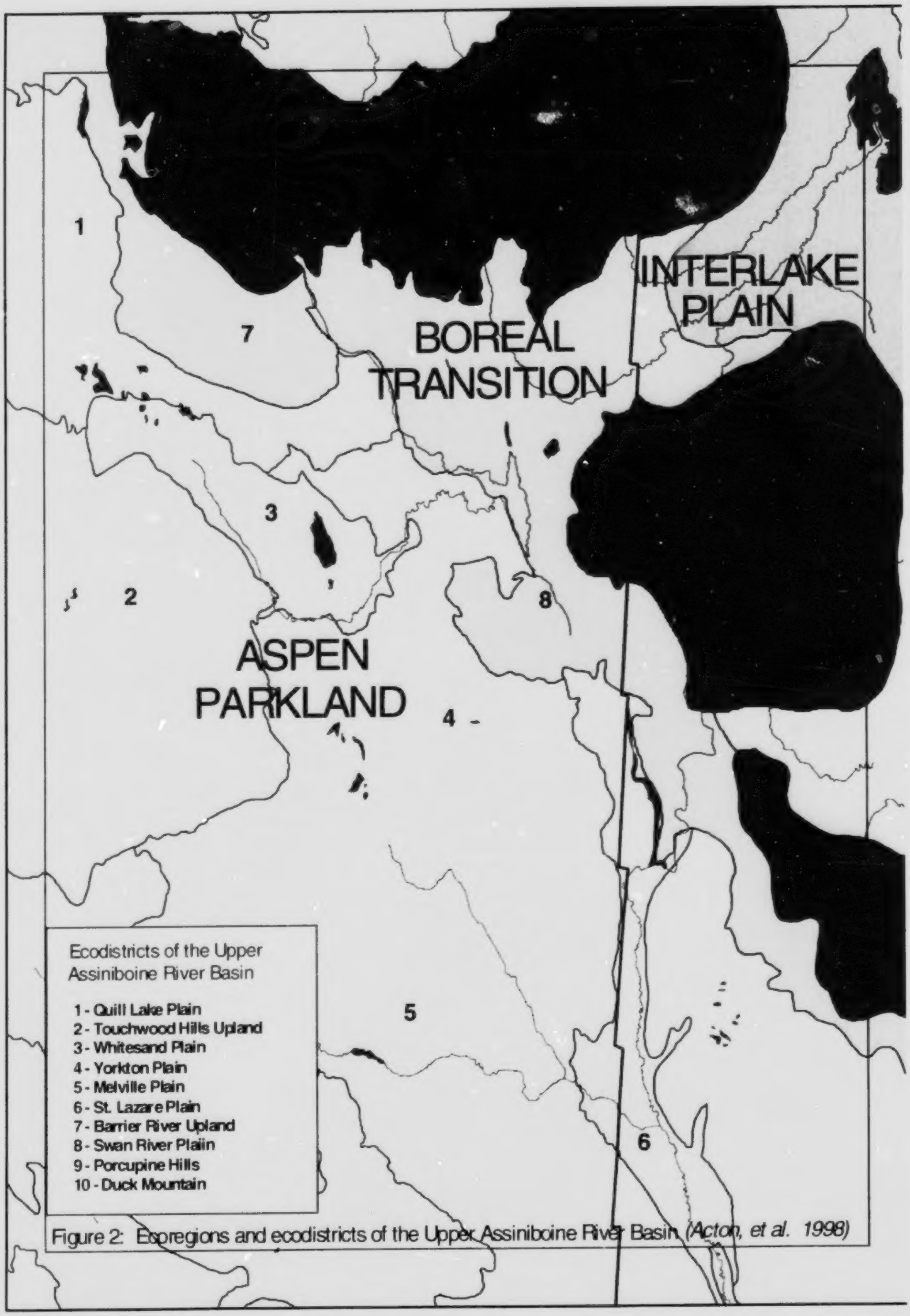


Figure 2: Ecoregions and ecodistricts of the Upper Assiniboine River Basin *(Acton, et al. 1998)*

chernozemic soils occurring on the outer fringes. The Boreal Transition Ecoregion contains the Barrier River Upland and the Swan River Plain. The Barrier River Upland is a gently to roughly undulating glacial till plain. Scattered throughout this plain are local sandy and silty glaciolacustrine plains. The soils are predominately gray luvisolic and dark gray chernozemic. Surface deposits in the peripheral areas of the Swan River Plain are thin lacustrine sediments over glacial till. Upper Cretaceous shales are exposed along the Assiniboine River.

The Aspen Parkland Ecoregion comprises most of the UARB area and consist of portions of the Whitesand, Quill Lake, Yorkton, and St. Lazare Plains (see Figure 2). Sandy soils dominate the Whitesand Plain where only about half of native habitat has been cultivated and substantial areas of aspen parkland remain. Thick black loamy soils of the Quill Lake Plain formed in glacial till deposits in association with gently sloping till plains and moderately sloping hummocky moraines. Most of this plain has been cultivated. Most of the Yorkton Plain has also been cultivated and the aspen parkland is heavily fragmented. Soils formed in both glacial till deposits and in silty glaciolacustrine deposits are common. Large areas of the St. Lazare Plain remain uncultivated, some of occurs within valleys associated with the Assiniboine River. A corridor along the Assiniboine River is dominated by valley complex regosolic soils (Richards and Fung 1969).

Wetlands in the river basin occupy kettles and shallow basins within glaciated terrain in valleys, streams, or channels, and in water-eroded landforms such as glacial lakebeds, floodplains, or deltas (Adams 1988). Lacustrine wetlands are situated in topographic depressions bounded by uplands or wetlands dominated by trees, shrubs, persistent perenniels, emergent mosses, or lichens. They include permanently flooded lakes, reservoirs, and intermittent lakes that generally have deep water and considerable wave action (Cowardin *et al.* 1979). Water levels under natural conditions are regulated by the overall water balance, and may decrease due to evaporation, transpiration, surface water outflow and seepage into the groundwater (Sloey, *et al.* 1978). Palustrine wetlands are discrete shallow basins that are isolated from surface water inflow from other wetlands, and contain a wide variety of vegetative types including trees, shrubs, persistent emergents, emergent mosses, or lichens. These include small, shallow, permanent or intermittent water bodies commonly called marshes or ponds (Sloey, *et al.* 1978; Cowardin *et al.* 1979).

1.2 Recent Area History

Wildlife have always played an important role in the UARB. Aboriginal tribes which inhabited this area at one time or another, and depended on the bounty of wildlife, included Assiniboine, Cree, and Gros Ventres (Richards and Fung 1969). The first Europeans to explore this region were fur traders, who probably began arriving sometime during the mid-18th century. Of particular interest to these explorers were fur-bearing mammals such as the beaver, wolf, mink, wolverine, and otter. Upon reading the accounts of the area recorded by these early traders, one gets the impression that wildlife was very plentiful. Daniel Harmon, a North West Company trader who lived at Fort Alexandria near the present town of Canora in 1800-1801, described the many natural riches (Harmon 1957). His journal entry from Sunday, May 2, 1801, reads "The animals in this vicinity are moose, red deer, a species of antelope, grey, black, brown, chocolate coloured and yellowish bears, two species of wolves, wolverines, polecats or skunks, lynxes, kitts, beavers, otters, fishers, martins, minks, badgers, muskrats and black, silver, cross and red foxes. Of fowls we have swans, geese, bustards, cranes, cormorants, loons, snipes, several species of ducks, water-hens, pigeons, partridges, pheasants…". It is interesting to note that the pigeons mentioned in this passage were more than likely the now extinct passenger pigeon. Houston (1972) summarized the former status of this species in Saskatchewan and concluded that it was a common migrant species across the prairies and a common breeding species in the Cumberland House and Porcupine Hills regions. This species was also reported during the breeding season by other fur traders and early settlers from the Upper Assiniboine River, Whitesand River, and near the present day communities of Kamsack and Runnymede (Houston 1972). Passenger pigeons were therefore likely a common migrant through the basin area, and possibly nested along the Assiniboine and Whitesand Rivers.

Probably most important were the herds of bison that moved from the surrounding prairie into the sheltered river valleys in winter and provided traders with a reliable supply of hides and meat. In his December 2, 1800 journal entry, Daniel Harmon wrote "The buffaloes are as yet a considerable distance farther out on the spacious prairies. Nothing but severe cold weather will drive them into the woody part of the country, to which they will come, in order to be less exposed to the wind and weather than they would be, to remain on the open plains." (Harmon 1957).

The seemingly unlimited fur supplies led to the establishment of a network of fur-trading posts along the major watercourses throughout the region. From these posts, furs were transported southeast to Winnipeg, Lake Superior, and points further east (Morton 1942). Two of these posts, the North West Company's Fort Alexandria and Hudson's Bay Company's Carlton House, were built in 1795 on the south shore of the Assiniboine River, 19 km north of the present town of Canora (Morton 1942). Fort Alexandria, although briefly shut down in 1806, remained in operation until 1821. Carleton House operated until 1800 and was re-opened as Fort Hibernia from 1807 until 1821. At this time all fur trading posts in the Assiniboine region, along with those along the Swan River, were combined into a single post at Fort Pelly.

The abundant wildlife that fuelled this fur trading economy did not persist for long. Before the end of the 19th century, the bison, wolf, wolverine, otter, and lynx were gone, while populations of beaver and moose had been drastically reduced (Bird 1961). Settlement of the area by Europeans and subsequent conversion of the land to agriculture occurred rapidly in the early part of the 20th century. This resulted in wide scale changes in the region's wildlife that are responsible for today's distribution of species within the river basin.

K. E. Baines, whose family was among the first to settle in the Crescent Lake area in 1883, described some of the changes in the area's wildlife during this time (Baines 1969). Using his grandfather's diary, he described how great quantities of bison bones and elk antlers from recently destroyed herds covered the prairie in 1883. No mention is made of the pronghorn documented by Daniel Harmon some eighty years earlier, and must have been obliterated by this time. Later Baines noted the sudden decline of mule deer in the first decade of the 1900's followed by its disappearance around 1928, and the subsequent arrival and proliferation of white-tailed deer shortly thereafter (Baines 1956). The mule deer "always paused to look at the hunter before they would run and hence were easy to shoot. None are seen now" (Baines 1969). Another area pioneer, William Niven, whose family moved to the Sheho area in 1910, described in great detail how the land was changed in the early years of settlement and its changes in bird populations (Niven 1973). He reported a decrease in populations of nearly all species of native birds during these post-settlement years as the land was cleared and converted for agricultural purposes.

Although many species that once flourished in this region do not occur now, the UARB still harbors a wide variety of wildlife species. Some are ubiquitous and widespread, occupying many different habitats while others are very localized due to specific habitat requirements. The most successful species have, and will continue to be, those that have adapted well to co-existing with humans and our vast changes to the landscape.

2.0 Characteristic Flora and Fauna of Wetlands and Uplands

Adams (1988) summarized different aspects of the definition of prairie wetlands. Less permanent wetlands undergo dramatic seasonal changes from open water ponds in spring to wet meadows dominated by grasses by summer. A central open water zone bordered by emergent vegetation characterizes semi-permanent and permanent wetlands. Fluctuations in water levels between seasons and among years result in dynamic changes in water level regimes, vegetation zonation, and vegetation structure.

For the purposes of this report, wetlands are categorically divided into basins, riparian wetlands, and lakes. Basins are classified as temporary, seasonal, semi-permanent, or permanent based on water permanence (Stewart and Kantrud 1972) and artificial wetlands are those created by human activity. Riparian wetlands along streams and rivers include those that have water flowing intermittently and those with permanent flow. Lakes are large permanent waterbodies that include those with exposed shorelines and those with vegetated shorelines.

2.1 Basin Wetlands

Each basin wetland type has a unique moisture regime in terms of how much surface water the basin holds and the length of time it remains. These factors determine the types of wetland vegetation and which wildlife species they will support, and habitat limitations due to environmental conditions such as short-term lowering of water levels due to drought. There are five different types of basin wetlands that differ widely in water depth and permanence: temporary, seasonal, semi-permanent, permanent, and artificial. The heterogeneity of wetland habitats within these basins result in a wide variety of utilization by wildlife species.

Wetland vegetation types occur in zones that correspond to different types of basin wetlands. Temporary basins support plant species characteristic of wet meadow vegetation such as grasses and sedges. Plant species representative of this vegetation type may also be present in the peripheral zones within seasonal, semi-permanent, and permanent basins. In addition to the wet meadow vegetation types found on their perimeters, seasonal basins support plant species characteristic of shallow marsh vegetation such as water-tolerant herbs and more robust grasses and sedges. The central areas of semi-permanent basins feature emergent deep marsh vegetation such as coarse emergents and submergent species, while shallow marsh and wet meadow vegetation types are found in characteristic zones towards the outer edges. The open water marsh zone in the central region of permanent wetlands will support submersed or floating vegetation, while shallower areas may support coarse emergents characteristic of deep marsh vegetation within semi-permanent basins. Similarly, shallow marsh and wet meadow vegetation types occur around the periphery.

Temporary Basins

The prairie landscape is characterized by innumerable small shallow depressions carved out by the advance and retreat of glaciers. These fill with water from melting snow in early spring but due to their shallow nature (generally, maximum depth < 10 cm), drying rapidly due to drawdown soon after the thawing of the bottom ice seal. These depressions may also hold water temporarily following heavy rains later in the year, or may be present on the margins of more permanent wetlands. Most are dry by the end of May, and are often cultivated. If left undisturbed, they develop into wet meadows with pioneering early-successional plant species such as wild barley and sow-thistle. Later stages are dominated by these species, along with fowl blue grass, northern reed grass, baltic rush, and woolly sedge.

Canadian Wildlife Service

Temporary basin in spring

Temporary basins warm rapidly in early spring, resulting in the early development of invertebrate populations (Swanson *et al* 1974). This provides crucial nourishment for early migrating ducks as well as arctic-nesting geese and shorebirds that frequently forage in these flooded fields en route to their breeding grounds during this time. These wetlands are important since they are the first wetland habitat in the prairie landscape where complex food webs are initiated following their release from winter's frozen grip.

Upon drying, these meadows are no longer used by water-associated birds but provide breeding habitat for birds of prey, such as northern harrier and short-eared owl, and songbirds such as the bobolink, western meadowlark, savannah sparrow, and Le Conte's sparrow. Occasionally, willows may become established if there are many consecutive disturbance-free years which provides breeding habitat for the alder flycatcher, loggerhead shrike, yellow warbler, common yellowthroat, and song sparrow. Many species of dabbling ducks use these meadows and surrounding uplands for nesting.

These wetlands, and the meadows they develop into, are extensively used by a variety of mammal species. Vegetation zonation dictates habitat use by small mammals Pendleton (1984). Six species can occur in wetland habitats within the UARB. Meadow voles and meadow jumping mice prefer habitat with higher levels of soil moisture and adequate vegetation for shelter. Thirteen-lined ground squirrels and deer mice also occur here, but favor drier areas. Sites of intermediate moisture were favored by both masked and short-tailed shrews. The Franklin's ground squirrel, which can be a significant predator on duck eggs (Cowardin *et al*. 1983), prefers more upland sites that border the edges of these and other wetlands.

The role of small mammals in wetland nutrient flow is poorly understood, but it has been suggested that they are likely not of great importance due to the low species diversity (six species), and low consumption rates of plant species documented in similar habitats in other geographic locations (Fritzel 1989). However the meadow vole has been reported to be the most numerous rodent species in this habitat, often accounting for more than 40 % of individuals (Fritzel 1989). These rodents play a key role in the life cycles of their predators, especially the short-eared owl, northern harrier, long-tailed weasel, and least weasel. Populations of these four predators all depend heavily on cyclical populations of these rodents (Fritzel 1989; Wellicome and Haug 1995; Errington and Breckeridge 1936; Polderboer *et al.* 1941).

Striped skunks are among the most numerous and widespread species of predator in the prairie region and they utilize all types of habitats. Temporary wetlands are used extensively by skunks as nocturnal foraging grounds throughout the spring, summer and fall (Fritzel 1989). Duck and songbird nests located in peripheral wet meadows and surrounding uplands are especially vulnerable to foraging skunks (Verts 1967).

Seasonal Basins

These wetlands have maximum water depths of up to one metre and usually become dry by late July, and are only cultivated during cycles of prolonged drought. Plant species occurring in these wetlands have adapted to the temporary nature of standing water (van der Valk and Davis 1978). Plant species characteristic of these basins include coarse grasses and sedges of intermediate height, such as tall manna grass, slough grass, awned sedge, and creeping spike-rush. Water-tolerant herbs such as common water-plantain, broad-fruited bur-reed and water-parsnip also thrive here, as well as floating plants such as various-leaved pondweed. Whitetop grass indicates more permanent water, while the presence of smartweed suggests drying of the wetland (Adams 1988).

Canadian Wildlife Service

Seasonal basin in summer

Communities of plants and invertebrates, which vary in species composition depending on water regimes and salinity, produce an abundant variety and supply of food for marsh-dwelling organisms (Swanson and Duebbert 1989). The shallow waters of these wetlands are very important to dabbling duck species that feed on organisms at or near the water surface. Seasonal basins have abundant invertebrate production which is very important in determining waterfowl use. This protein-rich food supply is especially critical to female ducks during the breeding season for egg production and brood rearing. Van der Valk (1989) found that ducklings of all waterfowl species in the early developmental stages have diets dominated by invertebrate species, comprising as much as 100% of their diets in some species, and after several weeks of development on an animal diet, some species are known to shift to diets comprised of more vegetable matter. These wetlands are also heavily used by migrant waterfowl in the spring, but rarely in the fall since they are usually dry.

Weller and Spatcher (1965) demonstrated that the most important factor for birds nesting in basin wetlands is vegetation structure. Wet sedge meadows on the perimeters of seasonal basins are used by nesting yellow rails, Wilson's phalaropes, common snipes, sedge wrens, and Le Conte's sparrows. Stands of emergent bulrush and cattail provide nesting habitat for American bittern, sora, Virginia rail, marsh wren, Nelson's sharp-tailed sparrow, and red-winged blackbird.

As the standing water begins to recede, the exposed mudflats are used for foraging by prairie shorebirds such as killdeer and American avocet, which nest along barren shorelines, and marbled godwit and willet, which nest in adjacent uplands. When evaporation of surface water from these shallow waters due to climatic factors and evapotranspiration of moisture from the tissues of wetland plant species exceeds the input of water from runoff and precipitation, these mudflats often develop into alkali flats. This process is the result of the concentration of salts built up in the soil from long term cyclic patterns of evaporation and flooding. These flats are very important foraging sites for the 23 species of shorebirds that migrate through the prairie pothole region as they travel to and from nesting areas in northern boreal forests or on the Arctic tundra (see Appendix 9). These shorebirds favor brackish waters that support large populations of protein-rich brine shrimp and plenty of other invertebrate species, which are an important energy source for meeting the physiological demands of shorebird migration. Arctic-nesting peregrine falcons also migrate through the area during this time and prey on this abundance of migratory shorebirds.

Small mammals inhabiting the margins of seasonal basins include meadow jumping mouse, deer mouse, and meadow vole. Predatory mammals such as red fox and long-tailed weasel, feed on these rodents as do birds of prey such as the northern harrier and the short-eared owl. Smaller mammalian terrestrial predators, such as masked shrew, pygmy shrew, and semi-aquatic amphibian predators such as northern leopard frog and boreal chorus frog, also occur along the margins of these wetlands where insects are abundant. Northern leopard frogs use temporary and seasonal wetlands for courtship activities (Kantrud *et al.*, 1989). Tiger salamanders often lay their eggs in seasonal wetlands and are somewhat adapted to saline conditions. After hatching, salamander larvae are completely aquatic, but leave these wetlands once they reach adulthood (Cook 1966). Seasonal wetlands are important for tadpoles of frogs and toads and salamander larvae that grow rapidly and reach adulthood in a short period of time (Galatowitsch and van der Valk 1994). Garter snakes also frequent these wetlands, feeding on plentiful prey items that include invertebrates, toads, frogs, salamanders, and small mammals found along the vegetated margins of these wetlands.

Semi-permanent Basins

Canadian Wildlife Service

Semi-permanent basin in summer

These wetlands usually have surface water persisting well into the fall and over the winter in most years. A mosaic of vegetation and open water is characteristic, with vegetation varying from uneven and patchy to completely overgrown. Floating and submergent vegetation in the open water zone may include pondweed and hornwort. Vegetation patches are typically dominated by coarse emergent vegetation such as cattail, great bulrush, river bulrush, prairie bulrush, and common reed grass.

Although ice cover of these wetlands disappears later than on temporary and seasonal wetlands and are therefore less important to foraging waterfowl early in the spring, nearly all of the prairie-nesting waterfowl use these basins for breeding activity. Weller and Spatcher (1965) found that use of these wetlands by breeding waterfowl was greatest when amounts of emergent cover and open water are approximately equal. These wetlands are also very important to prairie waterfowl for their summer molting, brood raising by females, and fall staging.

During the breeding season, dabbling ducks utilize the shallow waters of these wetlands for feeding and reproduction, and they nest in adjacent upland areas. The deeper open water zone is used by foraging pied-billed grebes, American coots, black terns, and numerous species of diving ducks where they nest on platforms of vegetation concealed in stands of emergent vegetation. Other bird species that build well-concealed nests in these emergent stands include American bittern, Virginia rail, marsh wren, red-winged blackbird, and yellow-headed blackbird. In extensive emergent stands where colonies of both red-winged and yellow-headed blackbirds co-exist, red-wings usually nest closer to the shoreline on the perimeter of the central zone which is occupied by colonies of yellow-heads. Horned and eared grebes also forage in the open water zone, but nest closer to shore on exposed platform nests attached to submersed vegetation. Formerly breeding in wetlands throughout the UARB (Houston 1949), a small population of sandhill cranes still breeds in the large wetland complexes south of Yorkton (Burke 1996). These wetlands are also used by migrating whooping cranes for roosting sites (Lewis 1995).

Woody vegetation, mainly willows, often develops around the edges of these wetlands provide nesting and foraging habitat for the alder flycatcher, yellow warbler, common yellowthroat, and song sparrow. Black-crowned night herons also breed in these wetlands, using thick stands of emergent cover or one of a variety of tree species (Davis 1993). A night heron colony at Upper Rousay Lake alternated between nesting sites in emergent vegetation and dense willows (Houston 1949).

Well-treed semi-permanent wetlands are important to white-tailed deer for shelter in fall and winter, especially if willows are the dominant tree species (Brewster and Longmuir 1994). Dense stands of cattails in these wetlands provide deer with excellent thermal cover during severely cold or windy weather during the winter months. Treed wetlands are also important for fawning and fawn-rearing in the spring and summer (Harmoning 1976; Brewster and Longmuir 1994). Woody vegetation growing on the margins of wetlands also offers browse for foraging deer.

Raccoons and striped skunks utilize all wetland types extensively, mainly for nocturnal foraging. Various wetland organisms comprise their omnivorous diets, including rodents, snakes, frogs, salamanders, crustaceans, aquatic insects, and the eggs and young of ground-nesting birds. While skunks are restricted to the dry margins of wetlands, the dominance of wetland organisms in raccoon diets (Fritzel 1989) suggests that their foraging habits are not restricted to the wetland margins. Dense emergent stands of wetland vegetation are often used as denning sites by skunks during the winter months (Fritzel 1989). Raccoons are known to use abandoned muskrat lodges for denning (Dorney 1954).

Mink are more closely associated with wetland habitats than any other mammalian carnivore in this region (Fritzel 1989). Food studies indicate that the proportion of animals in the mink diet vary seasonally (Waller 1962). The abundance of aquatic birds occupying wetlands during the spring, summer, and fall likely results in these species comprising the majority of prey items taken during these months. Mink are likely a major predator of muskrats due to their ability to overtake them in the water, which gives them an advantage over terrestrial predators such as coyote and red fox. Muskrats and small mammals are probably the main items taken in winter because all water-associated birds in the UARB migrate to warmer climates in winter. Mink are also more likely to explore other habitat types during the winter months due to the lack of food items in wetlands during this season.

Muskrats have the largest impact upon wetlands of all wildlife species inhabiting semi-permanent basins in the prairie pothole region. They are the primary grazing species in these wetlands and their activities have a large influence on the structure of the emergent vegetation, which affects other biotic communities within these wetlands (Fritzel 1989). The favored food of the muskrat throughout the northern prairies are cattails and bulrushes (Fritzel 1989). The tender shoots are eaten and the tougher leaves and stems are used in the construction of their dens or left to form floating mats of decaying vegetation that are used as feeding platforms. Therefore, muskrats are regarded as keystone species of these wetland communities because their activities result in alterations to their habitats that have dynamic implications, both positive and negative, for other species.

Although found in all wetland types, muskrats are abundant in semi-permanent wetlands. Muskrats must abandon semi-permanent basins during drought years if these wetlands dry out over the summer, and seek out deeper bodies of water that will have open water below the ice in winter. Muskrats build large, mound-shaped dens out of emergent vegetation. A den contains a large chamber for feeding and resting, as well as one or two plunge holes that are kept ice-free throughout the winter by muskrat activity, allowing access to underwater vegetation for winter sustenance. The portions of these dens that protrude above the water surface serve as substrates for some species of wetland vegetation (Kangas and Hannan 1985). They are also used for nesting sites by wetland bird species including Forster's and black terns (Weller and Spatcher 1965), and Canada geese (Hjertaas 1975). Mammalian species that use abandoned muskrat dens for shelter include meadow vole, mink (Errington 1963), and raccoon (Dorney 1954).

These wetlands are important for reptiles and amphibians. Northern leopard frogs, boreal chorus frogs, and Canadian toads breed in semi-permanent wetlands (Cook 1966) and then disperse to adjacent moist uplands for the rest of the summer (Kantrud *et al.* 1989a). Northern leopard frogs and western painted turtles may hibernate over the winter months in the mud at the bottoms of these and permanent wetlands.

Permanent Basins

Canadian Wildlife Service

Permanent basin in summer

These wetlands are permanently inundated and retain surface water throughout the year. They can be susceptible to drying out only following periods of extended drought. Sustained flooding results in an open water zone in the center of the wetland with submersed or floating types of vegetation. Shallow waters on the perimeters often support a distinctive band of coarse emergent vegetation such as cattail, great bulrush, and common reed grass. Water permanence results in decreased plant species diversity within these emergent stands when compared to other wetland types (van der Valk and Davis 1980) and peripheral vegetation characteristic of temporary and seasonal wetlands is often limited. This reduction in habitat diversity harbors fewer wildlife species. If a shoreline zone of coarse emergent vegetation is present, many of the marsh-nesting waterbirds also found in seasonal and semi-permanent wetlands may occur. Red-necked and horned grebes may occupy the central open water zone, nesting on exposed platforms of vegetation near the shore.

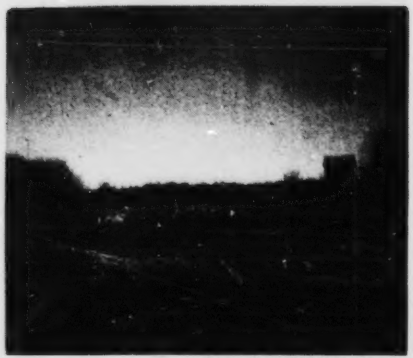
A variety of diving ducks, such as redhead, canvasback, and ruddy duck, may also occur. These species forage in the open water zone and nest in peripheral emergent growth. One species of dabbling duck, the green-winged teal, is a common summer resident of permanent wetlands in parkland regions. The stable water levels of these wetlands may be important for migrant waterfowl because they provide stopover habitats with more reliable water levels for resting purposes. The presence of peripheral wetland zones with vegetation characteristic of temporary, seasonal, and semi-permanent basins will result in greater vegetation diversity and increased utilization by wildlife species.

If fish are present, the central open water zones may be frequented by western grebes and Forster's tern that prey upon them and nest on platforms of vegetation concealed in coarse emergent stands along the shoreline. White-winged scoters may also occur if there is considerable open water and shrub-covered shorelines for nesting. Common terns and white-winged scoters prefer to nest on islands, therefore the presence of islands may make these habitats more attractive for these species.

There is often a ring, or partial ring of aspen or balsam poplar along the perimeter of these wetlands. Trees large enough to contain large cavities may attract cavity-nesting ducks such as wood duck, common goldeneye, bufflehead, common merganser, and hooded merganser. The latter two species specialize in pursuing and capturing small fish underwater.

Although many mammals use these wetlands for drinking and bathing, semi-aquatic mammals such as mink, muskrat, and beaver occur regularly in these lakes. Beaver will only be present if there are enough mature trees in adjacent areas, such as along riparian zones associated with outlet streams. These wetlands are also important to northern leopard frogs and western painted turtles that overwinter in the mud at bottom of the basin, and to tiger salamanders for breeding (Cook 1966).

Artificial Basins



Canadian Wildlife Service

Dugout in early spring

These man-made wetlands are scattered throughout the UARB. Dugouts are typically small rectangular-shaped excavations that are used for watering of domestic livestock. Wetland vegetation is often sparse or absent and they are usually surrounded by piles of excavated material. Stock ponds are created by constructing berms or other barriers which impound water along drainage channels. These are also used for livestock watering and often support emergent vegetation that provides valuable habitat for waterfowl, songbirds, small mammals, and amphibians (Trottier 1992). Seasonal lowering of water levels due to seepage and evaporation in these wetlands can result in lush vegetation cover. Borrow pits and gravel pits are created by the excavation of materials required as foundation for road construction and maintenance. Following removal of this material, some of these excavations may fill with water that seeps upward from the water table, or from spring meltwater and precipitation.

These artificial wetlands usually have a reduced shallow water zone due to steep slopes into the basin. Consequently they often have limited vegetation diversity, perhaps supporting small stands of emergent cattails or bulrush and possibly some submergents. They are most likely used by wildlife, as they are for cattle, as reliable sources of bathing and drinking water, and are therefore visited infrequently by mammal and bird species for this purpose. Occasionally waterfowl and shorebirds may visit these areas for foraging or resting purposes, and ducks may bring newly hatched ducklings to these basins. Killdeer, willet and marbled godwit sometimes nest in the vicinity of dugouts.

These ponds also provide important habitat for aquatic tiger salamander larvae, particularly during periods of drought (Andy Didiuk *pers. comm.*). Piles of excavated soil that surround dugouts and cutbanks created by the excavation of borrow pits and gravel pits are often used by burrowing mammals such as Richardson's ground squirrel, badger, and red fox. Colonial-nesting bank swallows often dig their short nest burrows into cutbanks, and in substrate piles if they are steep enough. These pilings are often bare of vegetation due to cattle activity and poor moisture retention. They are regularly used for perch sites by birds of prey such as the red-tailed and Swainson's hawk in summer, and by snowy owls during the winter months.

Sewage lagoons varying in size are found throughout the UARB. Unlike other artificial wetlands, the extremely nutrient-rich waters of sewage lagoons are important to both migrant and resident species of waterfowl and shorebirds for foraging, staging, nesting, and brood-rearing (Belanger 1994). The relatively stable water levels discourage the establishment of emergent vegetation, which precludes the presence of most marsh-nesting birds. The abundance of waterfowl nesting in the vicinity of these wetlands likely attract striped skunks, and raccoons, while the abundance of shorebirds during spring and fall migration also attracts raptors, such as peregrine falcon and its smaller relative, the merlin, that specialize in capturing birds in flight.

2.2 Riparian Wetlands

Riparian wetlands are found along watercourses such as creeks, streams and rivers and their adjacent banks. These habitats tend to have characteristics of both upland and aquatic ecosystems (Svejcar 1997), and they are very dynamic. Riparian wetlands fall into two categories: those that are permanent with flowing water throughout the year, and those that are intermittent with water flowing through them for only part of the year. Riparian wetlands are among the most ecologically diverse of all habitat types in the UARB and harbor a great diversity of flora and fauna. These areas are often very lushly vegetated, especially along some of the larger permanent flow watercourses in the northern part of the river basin such as the Assiniboine, Whitesand and Shell Rivers. The numerous intermittent streams, many of which are tributaries of these rivers, only carry water during spring runoff and during periods of heavy rain later in the year. Although they often support less diverse plant assemblages than that of permanent streams, they are very important for wildlife species.

Alan Smith

Riparian wetlands along a permanent river

Canadian Wildlife Service

Riparian wetlands along an intermittent creek

The convergence of different wet and dry habitats and dense vegetation associated with creeks and rivers offer food, cover and shelter for many wildlife species, resulting in a wide diversity of ecological niches for wildlife species to exploit. Since valley bottoms along creeks and rivers are often inundated due to runoff in early spring, and later exposed to drought conditions that often occur later in the summer, species of riparian vegetation have evolved an ability to tolerate a wide range of environmental conditions. The characteristics of these wetlands are dependent upon a number of factors: stream size, geology and hydrology of surrounding area, climatic variability, elevation, gradient, size of watershed, types of upland vegetation present, land management, and water use patterns (Svejcar 1997).

The main tree species in these areas are trembling aspen, balsam poplar, and white birch. The bur oak is widespread but locally distributed along the Assiniboine River throughout the southern half of the UARB (Adam *et al.* 1992) and stands of green ash can be found on the floor of the river valley. Understory vegetation is composed of shrubs such as Wood's rose, red-osier dogwood, beaked hazelnut, choke cherry, Saskatoon, river alder, western snowberry, and high-bush cranberry, and a herbaceous layer that includes northern bedstraw, two-leaved Solomon's seal, bunchberry, twinflower, tall lungwort, and dewberry. Ostrich ferns occur on poorly drained sites within riparian wetlands.

Some poorly-drained sites along the slopes of the Assiniboine River upstream from Lake of the Prairies contain vegetation communities more typical of boreal forests to the north (Adam *et al.* 1982). These may support localized populations of tamarack trees and shrubs such as Labrador tea and shrubby cinquefoil, and herbs such as glaucous grass-of-parnassus, cloudberry, and Kalm's lobelia. Tamarack and Labrador tea are believed to reach the southern limits of their Saskatchewan ranges in this area (Adam, *et al.* 1982).

A wide diversity of bird species can be found in these riverine habitats. Great blue herons that frequent the banks of these watercourses prey upon fish, amphibians and crayfish. Spotted sandpipers are found along rocky shores and beaver ponds, nesting in adjacent shoreline vegetation. If tree cavities are large enough, tree-nesting ducks such as wood duck, common goldeneye, bufflehead, common merganser, and hooded merganser may breed. Tree swallows and belted kingfishers nest in tree cavities along permanent watercourses. Along with bank swallows, kingfishers will also dig short nest burrows in eroded cutbanks along creeks and rivers.

Mature aspen forests along riparian corridors provide habitat for ruffed grouse, red-headed woodpecker, northern flicker, eastern wood-pewee, red-eyed vireo, veery, black and white warbler, American redstart, and white-throated sparrow. Alder flycatcher, cedar waxwing common yellowthroat, nashville warbler, northern waterthrush, song sparrow, and swamp sparrow will inhabit dense stands of shrubs and willows that are located between riparian wetlands and wooded uplands. Shrubby slopes along the banks of creeks and rivers in the northeastern portion of the UARB may be inhabited by the rare golden-winged warbler (Enid Cumming, *pers. comm.*). Bridges over creeks and rivers are commonly used as nesting sites for eastern phoebes and colonial-nesting cliff swallows. This habitat may be important to fruit-eating birds in winter, such as the bohemian waxwing and pine grosbreak, due to the diversity of fruit-bearing trees and shrubs.

Bird surveys were conducted in riparian woodland habitat in Aessippi Provincial Park at the south end of Lake of the Prairies during the summer of 1993 to assess the importance of this park for the yellow-throated vireo (William Koonz, *pers. comm.*). This study concluded that this area provided substantial habitat for this species which approaches the northwestern limit of its range in this area. Eighty-seven additional bird species of were recorded during surveys conducted over two days. In addition to the wide diversity of birds, 11 species of mammals, one species of reptile, and three species of amphibians were also recorded, reflecting the abundant productivity of wildlife in these riparian woodlands.

More open, grassy slopes on the banks of creeks and rivers provide habitat for the ground-nesting common nighthawk. Named for its proficiency at "hawking" insects on the wing during the night, this well-camouflaged species often sits motionless on the ground or horizontally on a tree branch during the daylight hours.

Open grassy areas with wooded borders provide edge habitats where different vegetation communities meet. These communities often blend along their borders, resulting in what is known as an ecotone. Edges and ecotones often contain extremely high numbers of wildlife species because of the combination of species characteristic of each different vegetation type. Consequently they are utilized by many wildlife species. An ecotone between grassland and a woodland, for example, may offer a woodland species such as the snowshoe hare, an opportunity to browse the tender shoots of newly emerged saplings with rapid access to adjacent dense woodland cover if a predator were to appear. Similarly, a grassland species such as the vesper sparrow may utilize an elevated perch in a young aspen tree along a woodland border to broadcast its territorial song.

The beaver is extremely important in its effects on riparian ecosystems. Johnson and Naiman (1987) consider the beaver as a keystone species since its influence on the ecosystem goes well beyond its requirements of food and living space. Dams constructed across streams and rivers slow the flowing water and cause sediment and debris to be deposited behind them. The dams may alter the hydrology and nutrient cycling in a stream, or perhaps even an entire river system. Elmore and Beschta (1987) suggest that removal of beaver and associated dams may result in downwater erosion from increased water flow. It has even been suggested that thousands of years of beaver activity may have created many of the west's fertile valleys (Kay 1994). Therefore, the activities of the beaver, like those of the muskrat in basin wetlands, have profound effects on other wildlife that share this habitat with these large rodents.

The little brown bat, northern myotis and red bat forage for flying insects at night over open water along watercourses and adjacent forests. Abandoned woodpecker holes, bark crevices, and the undersides of bridges are used for diurnal roosting sites (Pattie and Hoffmann 1992). Rodents such as least chipmunk, red squirrel, and woodchuck inhabit riverine forests. Other upland wildlife species depending heavily upon riparian zones for food and shelter include the black bear, coyote, raccoon, white-tailed deer, and moose.

The western painted turtle and northern leopard frog inhabit slow-moving creeks and rivers that have adjacent submerged vegetation. Shallow pools along these waters may contain large numbers of leopard frog tadpoles. The banks of riparian zones are important hunting areas for garter snakes, while adjacent moist wooded uplands provide foraging habitat for the wood frog. Small cavities, crevasses, and fissures often associated with dead or dying tree root systems, are used for dens known as hibernacula by garter snakes in winter.

Oxygen-rich water flowing in permanent creeks and rivers often support fish populations, which attract fish-eating species such as great blue heron, osprey, belted kingfisher, and mink. River otters may inhabit the more northern portion of the Assiniboine River and its associated tributaries. The diminutive and semi-aquatic water shrew also inhabits the banks of streams in the northern part of the river basin where it dives into fast-flowing waters in search of aquatic insects.

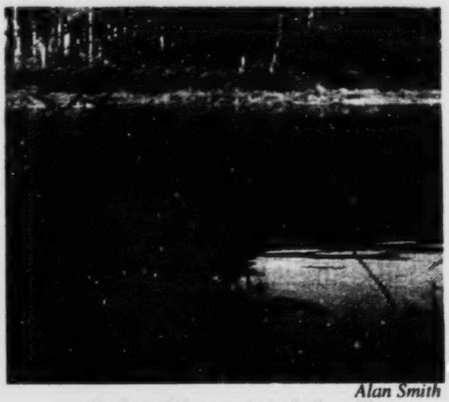
Mollusks are common aquatic invertebrates in the Assiniboine River and its tributaries. Clarke (1981) classified the Red River-Assiniboine River Region as one of nine distinct zoogeographic mollusk distribution regions in Canada. The different life cycle stages of these mussels are an important food source for aquatic and semi-aquatic mammals and birds, as well as fish. Fish are important to mussel populations because several fish species serve as hosts for developing mussel larvae, known as glochidia.

There is growing pressure from the freshwater mussel industry to implement commercial harvesting of the three ridge mussel, the only commercially viable species known to occur, in this portion of the river. Although no data are available for the UARB, mussel surveys along the Assiniboine River to the southeast near Portage la Prairie, Manitoba indicate the presence of at least eight species (Scaife and Janusz 1992). These surveys determined that population densities of three ridge mussels in the Assiniboine River appear to be too low to support an economically viable commercial harvest. Janusz (1992) found that populations of three ridge mussels in this portion of the river have some of the oldest individuals found anywhere, likely because they have never been harvested. Twenty-five per-cent of the population was found to be over 84 years of age, and one specimen was determined to be 231 years old, the oldest on record for this species. Scaife and Janusz (1992) recommended that the three ridge mussel, due to its long-lived and sedentary nature, has the greatest value as a scientific indicator of the environmental impacts of man-made structures such as dams, bridges, and treatment plants.

Aquatic invertebrates are also important components of riparian biodiversity because they provide nourishment for many wildlife species that forage along these watercourses. Crayfish inhabit all permanent streams, as well as larger, sand and gravel-bottomed lakes. In addition to scavenging, crayfish feed on abundant insect larvae and other invertebrates, and are preyed upon by herons, kingfishers, mink, and raccoon (Bird 1961, Weller 1994). Insects found in these waters that are preyed upon by a variety of wildlife species include the black fly, stonefly, caddisfly, mayfly, water boatmen, and water striders.

2.3 Lakes

Lakes throughout the parkland region such as Silver Lake, Fishing Lake, and Good Spirit Lake, usually have firm sand or gravel bottoms and shorelines (Bird 1961). Shorelines of these lakes may be open and exposed, or vegetated with emergent or shoreline vegetation. Many lakes in the basin are not deep or permanent enough to support fish populations. Low oxygen in late summer due to vegetation decay and low dissolved oxygen content at freeze-up in shallower lakes, make fish populations in these lakes vulnerable to winterkill.


Alan Smith

Lake with vegetated shoreline

Lakes that contain stable fish populations will attract fish-eating birds such as the western grebe, Forster's tern, and common tern. If coarse emergent vegetation is adequate for nest concealment these species will forage in the open water zone and build their platform nests in these emergent stands. Vegetated shorelines offer shelter and cover for shore-nesting species such as the common loon and white-winged scoter. The common loon is very sensitive to disturbance from human activities and is likely an uncommon to rare breeding species in the few permanent freshwater lakes within the UARB that support fish populations. Smith (1996) lists several confirmed and probable breeding records for these loons throughout the UARB. American white pelicans and double-crested cormorants may be found foraging for fish in these waters as non-breeding summer residents, or as visitors from distant nesting colonies. The nearest known pelican and cormorant breeding colonies are located at Mud Lake, situated between Little Quill Lake and Big Quill Lake, 35 km west of the UARB west boundary. Six surveys of these colonies between 1976 and 1991 resulted in an average of 329 pelican nests and 69 cormorant nests (Roney and Hlady 1984, Roney and Longmuir 1993). The maximum number of nests for each species was 655 for pelicans (1980), and 267 for cormorants (1976). Waterfowl bait pads in lakes such as Crescent Lake and Leech Lake are often used as resting areas for pelicans (Rob Kirkness, *pers. comm.*).

If shoreline trees are large enough, such as those that surround Fishing Lake, Horseshoe Lake, and Good Spirit Lake, they may be used by the colonial-nesting great blue heron. Bald eagles and osprey also nest in mature shoreline trees along large lakes and rivers. Although typically found breeding further north in the boreal forest ecoregions, Smith (1996) reported confirmed breeding for the bald eagle, and probable breeding for the osprey, on the southern edge of the Duck Mountains in the northeast portion of the UARB. Bald eagles also frequent larger lakes in the UARB in late fall, patrolling the shores in search of waterfowl crippled by hunters.

While lakes are important to mammals for the purpose of drinking and bathing, few species actually inhabit them. Beaver and mink are the only species that typically occur. River otter may inhabit some lakes in the northern reaches of the basin, especially if they are fed by outlet streams to major rivers. Crayfish, very common in these lakes, are heavily preyed upon by herons, kingfishers, mink, raccoons, and otters (Greer 1955), if they are present. Moose are known to feed on aquatic vegetation in the shallows of these lakes as well as in slow-moving creeks and rivers.

2.4 Uplands

UARB upland areas are classified by cover type as wooded cover, shrub cover, native grasslands (including native pastures), tame forage crops, and cereal cropland.

Wooded Uplands

Deciduous species such as trembling aspen, balsam poplar, Manitoba maple and white birch dominate woodlands of the UARB. One or more of a variety of willows often fringe these stands, especially in moist areas. Larger, more contiguous tree stands are typically found in the northern portion of the river basin. Many species of shrubs are found in the understory including green alder, choke cherry, Saskatoon, beaked hazelnut, wild gooseberry, and prickly rose. Herbaceous species include fireweed, wild sarsaparilla, palmate-leaved colts-foot, veiny meadow rue, smooth wild strawberry, and western Canada violet.

Alan Smith

Aspen Woodland

A variety of birds of prey occur in these woods, preying on the great diversity of birds and small mammals. Breeding species include northern goshawk, sharp-shinned hawk, broad-winged hawk, barred owl, and the ubiquitous great-horned owl. The diminutive northern saw-whet owl also breeds here, preying mainly on small rodents. Throughout the spring, the thumping sounds of the displaying male ruffed grouse are commonly heard. Of the five species of woodpeckers found in these wooded habitats, the yellow-bellied sapsucker and the crow-sized pileated woodpecker breed in the larger and more mature stands such as those in the northern regions of the basin and around Good Spirit Lake (Gunn 1968). The northern flicker, hairy woodpecker, and downy woodpecker are more widespread because they will nest in middle to younger-aged tree stands. The latter two species, along with the white-breasted nuthatch, are year-round residents of these woods.

The most diverse group of birds that utilize contiguous wooded upland habitat is the songbirds. Approximately 43 % of the songbird species known to breed in the UARB are known as neotropical songbirds. These species typically breed in Canada and the northern United States and winter far to the south in tropical areas such as the West Indies, Central America, and South America. Many neotropical species breed in woodland habitats within the UARB including the great crested flycatcher, Philadelphia vireo, red-eyed vireo, Swainson's thrush, mourning warbler, Connecticut warbler, ovenbird, American redstart, Baltimore Oriole and rose-breasted grosbeak. Other species that breed here but do not winter as far south include the hermit thrush, purple finch, and white-throated sparrow. In addition to these breeding species, vast numbers of neotropical species that breed in boreal forests further to the north pass through these wooded habitats during spring and fall migration, often stopping over for a day or more when it is necessary for them to replenish their energy supplies.

Mammals such as Gapper's red-backed vole, least chipmunk, woodchuck, red squirrel, northern flying squirrel, big brown bat, hoary bat, and snowshoe hare are common denizens of these woods. Although the fox squirrel is found in riparian woods further south, such as those along the Souris River, one individual was trapped in the woods in the vicinity of Stove Creek during the winter of 1982-83 (Adam 1984). The trapper had apparently seen a number of other individuals in the area around this time which suggests that these squirrels had expanded their range to the northwest along the Assiniboine River (Adam 1984). The present status of fox squirrels in the UARB is unknown. Another squirrel more typically found in areas to the southeast, the eastern gray squirrel, also appears to be expanding into wooded regions of the UARB. Individuals have been reported recently from Yorkton and the Good Spirit Lake area (Adam Schmidt, *pers. comm.*). It is possible that the presence of these two species of rodents are the result of human introduction.

Larger mammals present here include the omnivorous black bear and coyote, as well as browsing ungulates such as moose, elk, and white-tailed deer. Red-sided garter snakes, wood frogs, boreal chorus frogs, and Canadian toads occur here regularly (Preston 1982), especially if there are wetlands nearby. These amphibians forage for invertebrates that are plentiful on the forest floors and along the edges of these forests.

The UARB also contains mixed-wood forests. The Assiniboine and Shell Rivers originate on the southern edge of the Mid-boreal Upland Ecoregion and flow south through portions of the Boreal Transition Ecoregion (Acton, *et al.* 1998). Dominant tree species in these areas are the white spruce, trembling aspen, balsam poplar, and white birch. Black spruce, tamarack, balsam fir, and jack pine may also occur. Many herbs occur on the floors of these mixed-wood forests, including bishop's cap, hairy wild rye, vine-leaved coltsfoot, kidney-leaved violet, and common wintergreen. Mosses such as feather moss and knight's plume can be abundant.

Alan Smith

Mixed-wood Forest

Mixed-wood boreal forests contain the greatest diversity of breeding bird species of all ecosystems in North America (Smith 1980). In addition to bird communities also found in deciduous woods, many other neotropical songbird species may occur such as olive-sided flycatcher, western wood-pewee, blue-headed vireo, and a variety of warblers including yellow-rumped, magnolia, cape may, bay-breasted, black-throated green, and Canada warbler. Other resident species and short distance migrants inhabiting these mixed forests include barred owl, gray jay, red-breasted nuthatch, boreal chickadee, brown creeper, ruby-crowned kinglet, and white-winged crossbill. In addition to mammals found in deciduous woods, these mixed-wood stands may also support small populations of boreal forest mammals such as northern myotis, arctic shrew, heather vole, wolf, fisher, pine marten, and lynx.

Small, Isolated Woodlands

Canadian Wildlife Service

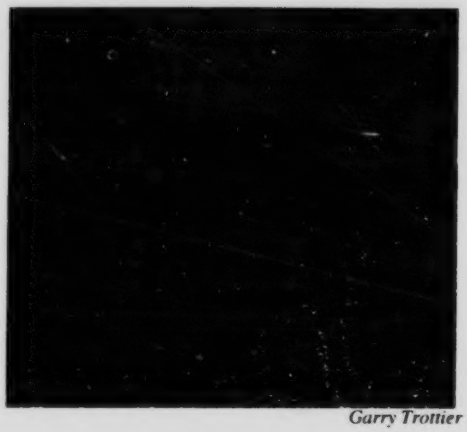
Fragmented aspen stands

Small stands of deciduous trees, commonly known as "bluffs", are typically found in areas of intensive agriculture in the southern portion of the UARB. These are mainly composed of trembling aspen and willow and often border wetlands or occur as isolated patches in farmland. The presence of woody vegetation around prairie wetlands is believed to be the result of fire suppression by prairie farmers (Bird 1961).

These woodlots are regularly inhabited by birds such as the Cooper's hawk, red-tailed hawk, mourning dove, long-eared owl, black-billed cuckoo, least flycatcher, house wren, brown thrasher, mountain bluebird, warbling vireo, and Baltimore oriole. The parasitic brown-headed cowbird is a common inhabitant of these woodlots. The cowbird traditionally followed nomadic herds of bison throughout the Great Plains, laying their eggs in the nests of other birds nests which enabled them to keep up with the constantly moving herds. With the demise of the bison, cowbirds have adapted very well to human changes in the landscape and are now much more sedentary. As a result they have become much more common and widespread, and cowbird nest parasitism has been implicated in the decline in productivity of many songbird species across North America (Lowther 1993). Cowbirds have adapted especially well to the small size and fragmentary nature of these woods that make it easier for them to find songbird nests to parasitize.

Mammals found in these small woodlots include the Franklin's ground squirrel, Gapper's red-backed vole, deer mouse, snowshoe hare, and porcupine (Pattie and Hoffmann 1992). Red squirrels, although more common in larger and more contiguous tree stands, are often found in these fragmented woods where they can be significant predators on the nests of ground-nesting birds (Bayne and Hobson 1997). Red-sided and western plains garter snakes forage in these woodlands, especially if wetlands are nearby.

Shrubs

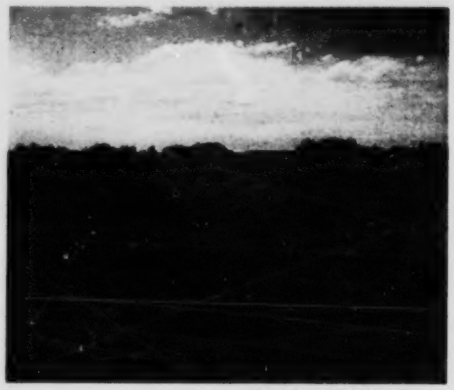


Garry Trottier

Wolf-willows invading native grassland

Shrubs grow in low, moisture-retaining depressions within grasslands and along water margins, and form the understories and edges of larger stands of trees. Common species of shrubs include western snowberry, wolf-willow, buffaloberry, Saskatoon, chokecherry, hawthorne, and beaked hazelnut. The shelter afforded by these shrubs is important to the white-tailed jackrabbit and Franklin's ground squirrel. Patches of shrubs in native grasslands provide important nesting habitat for mallard, gadwall, and American widgeon (Trottier 1992). Songbirds nesting in shrubby grassland habitat and on the borders of mature woods and wetlands include eastern kingbird, gray catbird, yellow warbler, common yellowthroat, indigo bunting, American goldfinch, and clay-coloured sparrow. Garter snakes, wood frogs, and Canadian toads may occasionally forage in shrubby areas.

Grasslands



Canadian Wildlife Service

Native grassland

Blue grama, speargrass, little bluestem, june grass, and wheatgrasses dominate grasslands of the UARB. Big bluestem, a grass species more characteristic of the tall grass prairie to the southeast, is often found on south facing prairie slopes along the Assiniboine River (Adam *et al.* 1982). This species likely reaches the northwest limit of its range in the Yorkton and Kamsack region, although the limits of its distribution limit are unknown (Dean Nernberg, *pers. comm.*). Herbaceous plants of grasslands include pasture sage, prairie crocus, little club moss, early yellow locoweed, three-flowered avens, and creeping juniper.

Grasslands of the prairie pothole region have been altered more than any other ecosystem in North America (Bird 1961). Vast expanses of native prairie were once grazed by enormous herds of bison, elk, and pronghorn. Today most of the grassland in the basin has been cultivated for agriculture and small remnant patches of native grassland are now grazed by domestic cattle. Simulating historic natural grazing patterns through proper grazing practices can maintain the viability of native grassland and minimize the negative effects of grazing on other wildlife species. This also benefits landowners by stabilizing financial return, lowering risks, and simplifying management (Trottier 1992). Overgrazing reduces the density and biomass of many plant and animal species, reduces overall biodiversity, interrupts ecological succession, impedes nitrogen cycling, changes habitat structures, and disturbs community organization (Fleischner 1994). McLaughlin and Mineau (1995) concluded grazing under any system has not been shown to enhance waterfowl production and is frequently detrimental to their populations. However, this topic is still heavily debated and more research is needed (M. Kornder, *pers. comm.*).

Wildlife use of native grassland is dependent upon vegetation height and structure which is affected by different grazing practices. Native prairie grasslands interspersed with shrubby growth provide nesting habitat for dabbling ducks. Mallard, American widgeon, and gadwall typically nest in patches of grass and shrubs, while northern pintail, northern shovelor, and blue-winged teal nest in patches of grass and forbs (Trottier 1992). Songbirds nesting in native grasslands include upland sandpiper, horned lark, Sprague's pipit, western meadowlark, chestnut-collared longspur, Baird's sparrow, vesper sparrow, and grasshopper sparrow. Table 1 lists some grassland bird species and their habitat preferences in response to grazing practices.

Table 1: Habitat preferences of some grassland bird species with respect to grazing practices that occur in the UARB (adapted from Trottier (1992)

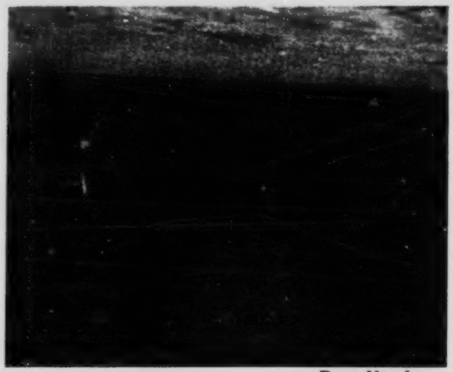
TALL, DENSE GRASSLAND (LIGHT OR NO GRAZING)	MEDIUM HEIGHT GRASSLAND (MODERATE GRAZING)	SHORT GRASSLAND (HEAVY GRAZING)
Savannah Sparrow	Sharp-tailed Grouse	Killdeer
Baird's Sparrow	Upland Sandpiper	Horned Lark
Clay-coloured Sparrow	Willet	
Grasshopper Sparrow	Sprague's Pipit	
Le Conte's Sparrow	Western Meadowlark	

The sharp-tailed grouse, Saskatchewan's provincial bird, establishes dancing grounds known as leks, on elevated areas of native prairie during the breeding season. Isolated trees, mainly aspen, or clumps of willow that develop in moist depressions may attract nesting Swainson's hawks, western kingbirds, eastern kingbirds, and loggerhead shrikes. Mountain bluebirds frequent grasslands that border wooded areas in which they breed.

Grassland mammals include inconspicuous species such as Hayden's shrew, prairie vole, meadow jumping mouse, northern pocket gopher, meadow vole, and long-tailed weasel. More conspicuous species include white-tailed jackrabbit, Richardson's ground squirrel, badger, coyote, and the ubiquitous red fox and striped skunk. The red-sided garter snake, western plains garter snake, and Canadian toad are often found here, especially if there are wetlands nearby. These three species, along with tiger salamanders, are known to overwinter in crevasses, abandoned rodent burrows, and ant hills found in grassland areas (Preston 1982; Cook 1966).

Tame forage

These are forage crops, such as alfalfa, white clover, and smooth brome, grown for livestock feed. Waterfowl species, such as mallard, northern shovelor, and American widgeon often nest in hay fields adjacent to wetlands. Although avoided by most typical grassland birds, vesper sparrow, savannah sparrow, Baird's sparrow, and clay-coloured sparrow, as well as western meadowlark and bobolink sometimes nest in these fields. The nests of these species are often destroyed by haying activities during the summer.

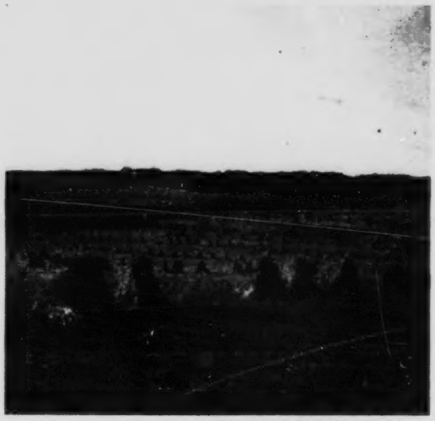

Dean Nernberg

Tame Forage Field

Rodents such as the deer mouse and the meadow vole also use these crops and are preyed upon by the coyote, red fox, and various birds of prey. During years of high meadow vole populations, these fields can support concentrations of rodent-eating hawks and short-eared owls, and in winter, snowy owls. This plentiful food supply may cause migratory species such as the rough-legged hawk, northern harrier, and short-eared owl to remain longer than usual into the fall. Northern pocket gophers also occur in tame forage where they dig their subterranean tunnel networks and feed on tender plant roots. These areas are largely avoided by reptiles and amphibians due to the lack of standing water and lower abundance of prey items.

Croplands

Croplands support very little wildlife due to the uniform species composition and structure of seeded plants. A variety of crop species are grown from year to year depending on market prices and growing conditions. Towards the end of May, as farmers are seeding these cultivated fields, arctic-bound shorebirds such as American golden-plover and buff-breasted sandpiper forage extensively in these fields for protein-rich invertebrates. Freshly burned stubble fields are also attractive for these species. Black-bellied plover often accompany these flocks, but seem to prefer fields that are flooded with spring meltwater.


Canadian Wildlife Service

Cropland

Other arctic-bound bird species foraging in these fields during spring and fall migration include large flocks of lapland longspurs, snow buntings, American pipits, and arctic populations of horned larks. Several species of gulls are also known to forage for invertebrates in tilled fields, often following farm equipment. Red-winged blackbird, yellow-headed blackbird and brewer's blackbird forage in croplands adjacent to breeding habitat. Croplands are used in winter by foraging gray partridge, sharp-tailed grouse, common redpoll, and snow bunting.

Croplands in the vicinity of large wetlands used as staging areas by waterfowl are subject to crop depradation. Crop predation by waterfowl cause little economic loss to farmers (Clark and Sugden 1986) compared to other impacts on the agricultural industry such as insects, weeds and disease (Arsenault 1994). It has been found that harvest duration (days in swath) and proximity of susceptible crops to staging wetlands are the major factors influencing crop damage by waterfowl (Jakimchuck 1969; Clark *et al.* 1993; Arsenault 1994). Croplands used to grow wheat and barley are used by whooping cranes during their migration between their breeding grounds in northeastern Alberta and southern Texas (Howe *draft report*). These croplands are widely distributed through most of the whooping crane migration corridor. Sandhill cranes also exploit these croplands (Hoffman 1976; Melvin 1982; Burke 1996).

Few bird species nest in croplands. Species that favor barren habitats such as killdeer and horned lark will occasionally nest on the bare ground in these fields soon after croplands are seeded and before seedlings mature. Later when the crop has formed a canopy, a few other bird species, such as western meadowlark and vesper sparrow, may occasionally nest. Upland nesting waterfowl are known to nest in higher densities in fall seeded cereal crops (one nest per 9 acres) than in conventionally seeded spring cereal crops (one nest per 45 acres) (Kornder *et al.* 1998). Ducks Unlimited (Canada) is currently investigating different agricultural production systems to determine which systems benefit wildlife and are agronomically and economically beneficial for producers (M. Kornder, *pers. comm.*).

Few mammal species dwell in these fields for extended periods of time. Deer mice, meadow voles, Richardson's ground squirrels, white-tailed jackrabbits, and white-tailed deer may forage in cropland, especially if there is more suitable adjacent habitat available for cover. If there are barren patches, such as on eroded areas on steep hillsides, Richardson's ground squirrels may establish small colonies. The red fox and the badger may also dig burrows in these areas. The lack of standing water and prey in these areas limit the use of these areas by reptiles and amphibians.

3.0 Frequency of Use of Habitats by Wildlife Species

Table two summarizes breeding habitat utilization by wildlife species in the UARB from the matrix in Appendix Eight. The number of mammal, bird, reptile and amphibian species known or suspected to breed in each habitat type is listed followed by the percentage of the total number of species within each respective order that are known or suspected to breed in the UARB. For example, the eight species of mammal known or suspected to breed in habitats associated with temporary basins represents 17 % of the total number of mammal species known or suspected to breed in the UARB.

Basin wetlands support equal percentages (30 %) of breeding bird and mammal species. Within basin wetland types, seasonal basins support the greatest diversity of breeding mammal species (22 %) while seasonal and semi-permanent basins support the greatest diversity of breeding birds (23 %). Basin wetlands are very important to amphibians and reptiles, with 80 % of reptiles and all amphibian species utilizing these habitats for breeding.

Riparian wetlands are important breeding habitat for a large proportion of wildlife species occurring in the UARB with 50 % of mammal species, 21 % of bird species, and 80 % of amphibian and reptile species, respectively, known or suspected to breed in these habitats. Permanent riparian wetlands support a greater diversity of breeding fauna than intermittent riparian wetlands. Lakes are of little importance to breeding mammals and but are used by 29 % of breeding birds species, 67 % of breeding reptile species, and 80 % of breeding amphibian species. Lakes with vegetated shorelines support a greater diversity of breeding fauna than lakes with exposed shorelines.

Wooded, shrubby and native prairie uplands support a great diversity of breeding birds (68 %), mammals (85 %) and reptiles (67 %) but are not used by breeding amphibians. Of these upland types, wooded uplands support the highest diversity of breeding fauna. Forage and cereal croplands are of the least importance of all habitats for breeding wildlife. Only 13 % of mammal species, and 9 % of bird species use these habitats for breeding. No amphibians or reptiles breed in these croplands.

Table three summarizes foraging habitat utilization by wildlife species in the UARB from the matrix in Appendix Nine. The number of mammal, bird, reptile and amphibian species known or suspected to forage in each habitat type is listed followed by the percentage of the total number of species within each respective order that occur in the UARB. For example, the 23 species of mammal known to forage in habitats associated with temporary basins represents 47 % of the total number of mammal species that occur in the UARB.

Basin wetlands are important foraging habitats for many wildlife species in the UARB with 54 % of mammal species, 35 % of bird species, and all reptile and amphibian species known to occur in the UARB foraging in habitats associated with these wetlands. Riparian wetlands are used for foraging by 60 % of mammal species, 26 % of birds and all reptiles and amphibians that occur in the UARB. Lakes are used for foraging by 25 % of mammal species, 37 % of bird species, 67 % of reptile species and all amphibian species that occur in the UARB.

Wooded, shrubby and native prairie uplands provide foraging habitat for 90 % of mammal species, 64 % of bird species, 67 % of reptile species, and 60 % of amphibian species known to occur in the UARB. Forage and cereal croplands provide foraging habitat for 21 % of mammals species and 23 % of bird species known to occur in the UARB. No reptiles or amphibians are known to forage in these habitats.

Large differences in the number of species utilizing habitats for breeding and foraging demonstrates that many species have specific breeding habitat requirements but utilize a variety of foraging habitats. The number of bird species foraging in some habitats is magnified due to the presence of foraging bird species that migrate through the UARB but do not remain to nest. Arctic-bound shorebirds, for example, considerably increase the number of bird species foraging on lakes with exposed shorelines compared with the number of bird species that breed there.

Table 2: Wildlife breeding habitats in the Upper Assiniboine River Basin

HABITAT TYPE	NO. OF MAMMAL SPECIES	NO. OF BIRD SPECIES	NO. OF REPTILE SPECIES	NO. OF AMPHIBIAN SPECIES
Temporary Basin	8 (17 %)	23 (12 %)	2 (67 %)	5 (100 %)
Seasonal Basin	10 (22 %)	43 (23 %)	3 (100 %)	5 (100 %)
Semi-permanent Basin	5 (11 %)	43 (23 %)	3 (100 %)	5 (100 %)
Permanent Basin	5 (11%)	41 (22 %)	3 (100 %)	4 (80 %)
Artificial Basin	0 (0 %)	17 (9 %)	2 (67 %)	4 (80 %)
TOTAL	*14 (30 %)*	*56 (30 %)*	*3 (100 %)*	*4 (80 %)*
Intermittent Riparian	**18 (39 %)**	**24 (13 %)**	**3 (100 %)**	**4 (80 %)**
Permanent Riparian	**23 (50 %)**	**39 (21 %)**	**3 (100 %)**	**4 (80 %)**
TOTAL	***23 (50 %)***	***39 (21 %)***	***3 (80 %)***	***4 (80 %)***
Exposed Shoreline Lake	0 (0 %)	18 (10%)	0 (0 %)	4 (80 %)
Vegetated Shoreline Lake	4 (9 %)	45 (24 %)	2 (67 %)	4 (80 %)
TOTAL	*4 (9 %)*	*55 (29 %)*	*2 (67 %)*	*4 (80 %)*
Wooded Upland	**29 (63%)**	**99 (53 %)**	**2 (67 %)**	**0 (0 %)**
Shrub Upland	**13 (28 %)**	**33 (18 %)**	**0 (0 %)**	**0 (0 %)**
Native Grassland Upland	**18 (39 %)**	**33 (18 %)**	**2 (67 %)**	**0 (0 %)**
TOTAL	***39 (85 %)***	***128 (68 %)***	***2 (67 %)***	***0 (0 %)***
Tame Forage Upland	6 (13 %)	16 (8 %)	0 (0 %)	0 (0 %)
Cropland Upland	5 (11 %)	13 (7 %)	0 (0 %)	0 (0 %)
TOTAL	*6 (13 %)*	*17 (9 %)*	*0 (0 %)*	*0 (0 %)*

Table 3: Wildlife foraging habitats in the Upper Assiniboine River Basin

HABITAT TYPE	NO. MAMMAL SPECIES	NO. OF BIRD SPECIES	NO. OF REPTILE SPECIES	NO. OF AMPHIBIAN SPECIES
Temporary Basin	23 (47 %)	79 (33 %)	3 (100 %)	5 (100 %)
Seasonal Basin	24 (49 %)	92 (38 %)	3 (100%)	5 (100 %)
Semi-permanent Basin	13 (27 %)	95 (39 %)	3 (100 %)	5 (100 %)
Permanent Basin	14 (29 %)	77 (32 %)	3 (100 %)	5 (100 %)
Artificial Basin	5 (10 %)	55 (23 %)	3 (100 %)	5 (100 %)
TOTAL	*26 (54 %)*	*86 (35 %)*	*3 (100 %)*	*5 (100 %)*
Intermittent Riparian Wetland	**26 (53 %)**	**55 (23 %)**	**3 (100 %)**	**5 (100 %)**
Permanent Riparian Wetland	**29 (59 %)**	**64 (26 %)**	**3 (100 %)**	**5 (100 %)**
TOTAL	***29 (60 %)***	***64 (26 %)***	***3 (100 %)***	***5 (100 %)***
Exposed Shoreline Lake	10 (20 %)	79 (33 %)	0 (0 %)	5 (100 %)
Vegetated Shoreline Lake	12 (24 %)	63 (26 %)	2 (67 %)	5 (100 %)
TOTAL	*12 (25 %)*	*90 (37 %)*	*2 (67 %)*	*5 (100 %)*
Wooded Upland	**31 (63 %)**	**116 (48 %)**	**2 (67 %)**	**2 (40 %)**
Shrub Upland	**17 (35 %)**	**47 (19 %)**	**2 (67 %)**	**2 (40 %)**
Native Grassland Upland	**24 (49 %)**	**55 (23 %)**	**2 (67 %)**	**2 (40 %)**
TOTAL	***43 (90 %)***	***155 (64 %)***	***2 (67 %)***	***3 (60 %)***
Tame Forage Upland	10 (20 %)	52 (21 %)	0 (0 %)	0 (0 %)
Cropland Upland	10 (20 %)	55 (23 %)	0 (0 %)	0 (0 %)
TOTAL	*10 (21 %)*	*55 (23 %)*	*0 (0 %)*	*0 (0 %)*

4.0 Rare, Threatened, and Endangered Species

Rare, threatened, and endangered species are categorized by a variety of agencies, each with its own criteria. Those mentioned here include The Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and Manitoba and Saskatchewan Conservation Data Centres. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies, varieties and nationally significant populations that are considered to be at risk in Canada (COSEWIC 1998). In its 1998 report, the committee determined that four species of breeding or formerly breeding birds, one amphibian and one butterfly occurring in the UARB are 'at risk'. The Manitoba Department of Natural Resources and Saskatchewan Environment and Resource Management have similar designations for provincially threatened, endangered, extirpated and extinct species. The Saskatchewan Conservation Data Centre and Manitoba Conservation Data Centre have S1 (very rare) and S2 (rare) provincial designations for rare and endangered species. Rare plants follow criteria of Harms *et al.* (1992), Manitoba Conservation Data Centre and Saskatchewan Conservation Data Centre.

4.1 Whooping Crane

Canadian Wildlife Service

Whooping Cranes

Before the arrival of European settlers in the early 1900's, the whooping crane bred in large marshes within the aspen parkland belt and in the transition zone between parkland and grassland (Allen 1952), including the southwestern portion of the UARB. Hjertaas (1994) compiled historic whooping crane nest records in Saskatchewan and reported three confirmed records from the late 1800's and early 1900's within the UARB (see Table 4).

Table 4: Confirmed nesting locations (C), suspected breeding records (P), and summering records (S) of whooping cranes in the UARB (from Hjertaas, 1994)

STATUS	DATE	LOCATION	# OF EGGS
C	1890's	Battersby's Lake	2
C	May 16, 1900	Near Yorkton	2
C	Approximately 1900	4 mi. west, 1 mi. south of Springside	1
P	1893	1 mi. south, 2.5 mi. west of Bredenbury	
P	1894-1895	Shillingthorpe Lake	
S	Between 1900 and 1910	Southwest of Rokeby	
S	1948	Near Invermay	

The whooping crane was designated as endangered in 1978 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 1998). It is also designated as endangered by the Manitoba Department of Natural Resources and Saskatchewan Environment and Resource Management. An endangered species is defined as one that is facing imminent danger of extirpation or extinction. The Manitoba Conservation Data Centre and the Saskatchewan Conservation Data Centre assign the whooping crane an S1 ranking, which is defined as extremely rare and critically imperiled.

The whooping crane no longer breeds in the UARB, or anywhere else on the prairies. Although the main migratory route between their breeding grounds in Wood Bison National Park in northern Alberta and their wintering grounds in southeast Texas lies to the west of the UARB, they do occasionally migrate through the UARB. Of 1937 confirmed and probable whooping crane migration stopover records from across the prairie provinces between 1910 and 1998 (see Figure 3), 41 (2.1 %) occurred within the UARB (Brian Johns, *unpub. data*).

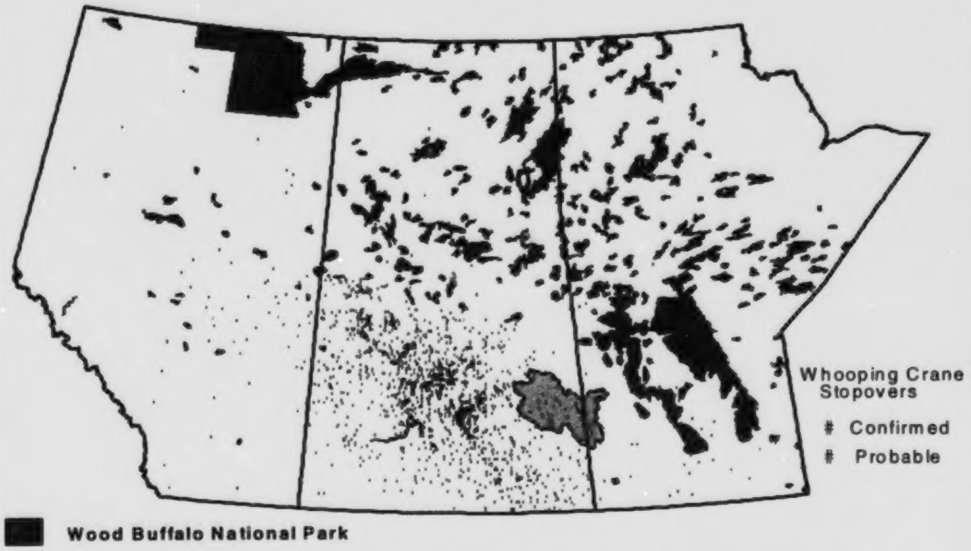
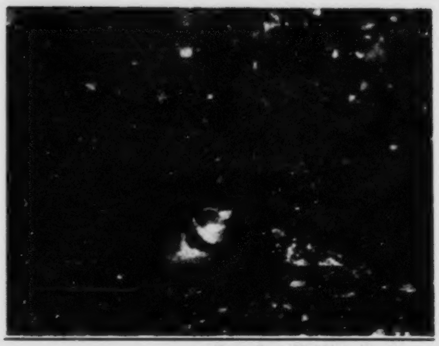


Figure 3: Confirmed and probable Whooping Crane migration stopovers across the prairie provinces (1910-1998) *(Brian Johns unpublished data 1999)*

Lyon *et al* (1995) recently evaluated three regions in eastern Saskatchewan: Yorkton, Saskatchewan River delta, and Overflowing River; as potential sites for whooping crane reintroduction as part of The National Recovery Plan for the Whooping Crane. This plan calls for the establishment of an independent wild population with a minimum of 25 breeding pairs of whooping cranes in Canada by 2020 (Edwards, *et al.* 1993). Three wetland complexes comprise the Yorkton region: Horseshoe Lake, Rokeby Marsh, and the Yorkton South Complex. Although the Yorkton region would be the easiest location for such a reintroduction program, it also has the greatest number of hazards to whooping cranes. These include: a small wetland area (compared to the other two sites), many power lines in the vicinity, lower populations of large invertebrates required as food for cranes, significant potential for disturbance and human interference due to its close proximity to Yorkton, unknown risks posed by the use of agricultural chemicals in surrounding farmland, and habitat vulnerability because wetland complexes in this region are prone to drought (Lyon, *et al.* 1995). This proposed reintroduction plan is currently on hold pending the evaluation of a possible reintroduction site in Wisconsin (Brian Johns, *pers. comm.*).

4.2 Piping Plover

The piping plover breeds across southern Canada from Alberta to Newfoundland, the northcentral United States and along the Atlantic coast to Virginia. They winter on the Atlantic coast from South Carolina to southern Florida, and along the Gulf Coast to Texas (Godfrey 1986). Piping plovers favor exposed, pebble-covered shorelines of saline and freshwater prairie lakes.



Canadian Wildlife Service

Piping Plover

Originally designated as threatened by COSEWIC in 1978, it was uplisted to endangered in 1985. A threatened species is one that is likely to become endangered if limiting factors are not reversed and an endangered species is one that faces imminent extirpation or extinction (COSEWIC 1998). The Manitoba Department of Natural Resources and Saskatchewan Environment and Resource Management have also designated this species as endangered. The Manitoba Conservation Data Centre and Saskatchewan Conservation Data Centre give these plovers an S2 ranking, which is defined as rare and imperiled (Manitoba Conservation Data Centre 1998; Saskatchewan Conservation Data Centre 1998).

Breeding was confirmed in 1936 when a pair nested at the south end of Good Spirit Lake (Houston 1949), however, piping plovers disappeared as a breeding species from there in the 1950's (Renaud, *et al.* 1979). A 1996 survey of piping plovers found that nearly 8% of the North American breeding population of piping plovers were found on the nearby Quill Lakes (Skeel *et al.* 1997), but there are no recent breeding records from the UARB, and it likely occurs only during migration. Although the piping plover can occur as a migrant in the UARB, it is not important to this species.

4.3 Burrowing Owl

The burrowing owl inhabits treeless plains of southern portions of western Canada, the western United States, Central and South America. It retreats from northern areas in winter (Godfrey 1986). These owls are unique because they are often active during daylight hours and nest in abandoned underground burrows of the badger and Richardson's ground squirrel, in areas of grazed native grassland.

Canadian Wildlife Service

Burrowing Owl

Originally designated as threatened by COSEWIC in 1979, it was uplisted to endangered in 1995 (Wellicome and Haug 1995), therefore it faces imminent extirpation or extinction (COSEWIC 1998). The Manitoba Department of Natural Resources and Saskatchewan Environment and Resource Management also list the burrowing owl as endangered. The Manitoba Conservation Data Centre and the Saskatchewan Conservation Data Centre give these plovers an S2 ranking, which is defined as rare and imperiled (Manitoba Conservation Data Centre 1998; Saskatchewan Conservation Data Centre 1998).

Burrowing owls have recently experienced a dramatic decline in the northern parts of its range due to the extensive cultivation of native grassland, fragmentation of remaining grassland, pesticide use, and recent population increases of predators such as the red-tailed hawk, great-horned owl, red fox and striped skunk (Wellicome and Haug 1995) brought on by human-related changes in the post-settlement prairie landscape. Historically, burrowing owls bred throughout the grassland regions of Saskatchewan (Smith 1996), which likely included the UARB, but recent evidence is scarce. There was a report of a nest burrow in the Theodore, Saskatchewan area in the late 1980's (Bill Anaka, *pers. comm.*). Native prairie habitat that still exists in the Manitoba portion of the basin may support small populations of these owls (Ken De Smet, *pers. comm.*). The range contraction of this species and scant recent evidence of occurrence suggests the present range of the burrowing owl has contracted into southern areas and it likely no longer occurs in the UARB.

4.4 Loggerhead Shrike

This predatory songbird breeds across southern Canada from Alberta to Nova Scotia, and throughout the United States to southern Mexico, and winters from the central United States southward (Godfrey 1986), often nesting in shelterbelts that border farmsteads, and patches of willow that develop in moist areas.

Canadian Wildlife Service

Loggerhead Shrike

Loggerhead shrikes were designated as threatened by COSEWIC in 1986. A threatened species is likely to become endangered if limiting factors are not reversed (COSEWIC 1998). The Manitoba Department of Natural Resources lists the loggerhead shrike as endangered. An endangered species is one that faces imminent extirpation or extinction. The Manitoba Conservation Data Centre gives this species an S2 ranking, which is defined as rare and imperiled (Manitoba Conservation Data Centre 1998).

These shrikes have been declining from the northern and eastern limits of its range in recent times (Cadman 1985). Widespread conversion of native grassland for agricultural use is believed to be the major factor for this decline as well as poisoning campaigns against grasshoppers, which make up a significant proportion of their diets (Yosef 1996). Despite this, it is still a fairly common summer resident throughout the grassland and southern parkland regions of Saskatchewan (Smith 1996). This is reflected by the S4 ranking assigned by the Saskatchewan Conservation Data Centre which is defined as common and demonstrably secure (Saskatchewan Conservation Data Centre 1998). Shrike surveys conducted during the breeding season in 1987, 1991, and 1996 in the Yorkton area indicate that few, if any shrikes occur in the UARB and they are likely very rare in the Saskatchewan portion of the UARB due to the dominance of aspen parkland in the region (Brian Johns, *pers. comm.*). A long-time area resident of the Good Spirit Lake area remembers often seeing frogs and grasshoppers impaled on barbed wire fences by shrikes in the western portion of the UARB until around the 1960's (Bill Anaka, *pers. comm.*). Shrikes then rapidly began to disappear and they have not been seen in that area since the 1970's. They are most likely to be found in the southern portion of the basin in the vicinity of native grassland with adjacent shrubbery or hedgerows for nesting. Breeding Bird Survey data from Smith (1996) indicates that there has been a highly significant (-5.9%) decline of loggerhead shrike populations in Saskatchewan on survey routes conducted between 1968 and 1992.

4.5 Ferruginous Hawk

Canadian Wildlife Service

Ferruginous Hawk

The ferruginous hawk was once a common prairie raptor throughout the entire grassland region of western North America, reflecting the range of the Richardson's ground squirrel, its main prey. These hawks now occupy about half of their original range in Canada mainly due to habitat loss (Schmutz 1994) from agricultural activities and subsequent reduction in ground squirrel populations.

The ferruginous hawk was designated threatened by COSEWIC in 1980 and downlisted to vulnerable in 1995 (COSEWIC 1995). This species is also listed as threatened by the Manitoba Department of Natural Resources. A threatened species is one that is likely to become endangered if limiting factors are not reversed and a vulnerable species is one that is of special concern because of characteristics that make it particularly sensitive to human activities or natural events. The Manitoba Conservation Data Centre assigns a rank of S2, which indicates that it is rare and imperiled (Manitoba Conservation Data Centre 1998).

Evidence of this species in the UARB is scant. Houston (1949) described it as "Uncommon, though once a fairly common summer resident in open country; apparently its numbers have decreased considerably." Although Smith (1996) indicates no post-1966 breeding for the Saskatchewan portion of the UARB, populations appear to be slowly increasing across the rest of southern Saskatchewan. This is reflected by the S4 ranking assigned by the Saskatchewan Conservation Data Centre which is defined as common and demonstrably secure (Saskatchewan Conservation Data Centre 1998). An adult ferruginous hawk observed in potential breeding habitat near Shellmouth, MB, on 11 May, 1989, indicates that this species still possibly breeds in the remaining grasslands of the Manitoba portion of the UARB (Ken De Smet, *pers. comm.*). While areas of native grassland habitat do exist in the southern portion of the UARB, the few recent area records for this species suggest that it is rare at best.

4.6 Short-eared owl

Canadian Wildlife Service

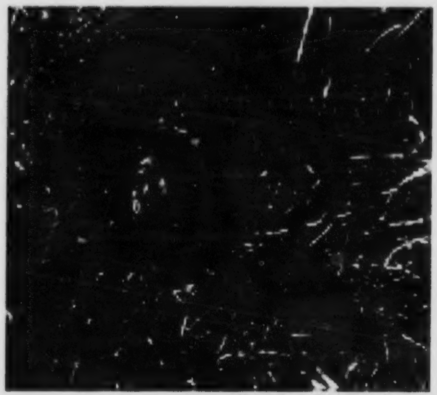
Short-eared Owl

The short-eared owl is found across Asia, Europe, North and South America, withdrawing from northern regions in winter (Godfrey 1986). Due to the vast reduction of wetlands and native grassland used for breeding habitat, the short-eared owl has been a recent victim of intense cultivation in southern Saskatchewan (Smith 1996), which has resulted in reduction in its breeding range in agricultural and developed areas (Cadman 1994). Populations of this owl are cyclic, reflecting population fluctuations of microtine rodents (voles), which are its preferred prey (Holt and Leasure 1993). Populations of these owls and their rodent prey are vulnerable to habitat alteration through land use practices such as wetland drainage and grassland cultivation.

The short-eared owl was designated vulnerable by COSEWIC in 1994 (COSEWIC 1995). A vulnerable species is defined as a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. The Manitoba Conservation Data Centre assigns a rank of S3, which indicates that it is rare to uncommon and may be susceptible to extirpation by large scale disturbances (Manitoba Conservation Data Centre 1998). The Saskatchewan Conservation Data Centre assigns an S4 ranking, which is defined as common and demonstrably secure (Saskatchewan Conservation Data Centre 1998).

Within the UARB, these owls are likely uncommon residents of the larger, more expansive wetland complexes such as Barvas Marsh, east of Yorkton, and those south of Yorkton, and probably rare elsewhere within the UARB. During cyclic population climaxes of microtine rodents this owl temporarily becomes a fairly common resident among wetland and native grassland habitats. Breeding Bird Survey data from Smith (1996) indicates that short-eared owls have decreased significantly (-2.7 %) on Saskatchewan survey routes between 1968 and 1992

4.7 Baird's Sparrow



Canadian Wildlife Service

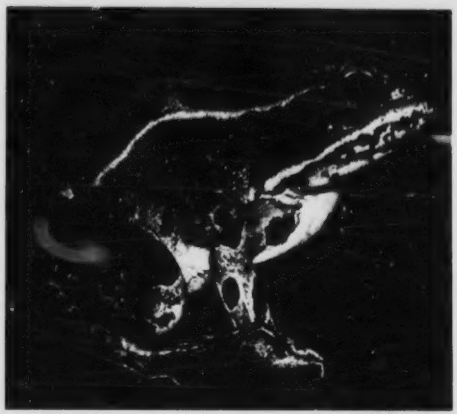
Baird's Sparrow

The Baird's sparrow breeds throughout the northern Great Plains of North America and winters in southern portions of Arizona, New Mexico, and Texas, and in northern Mexico (De Smet and Miller 1989). Breeding habitat includes ungrazed or lightly grazed native grasslands, hayfields, and weedy croplands (Smith 1996).

This species was listed as threatened in 1989 by COSEWIC (Goossen *et al.* 1993) as a result of widespread concern because it was thought to be a native prairie specialist (Cartwright *et al.* 1937) that had suffered declines proportionate to the demise of North American grasslands (De Smet and Miller 1989). In 1994 the Saskatchewan Wetland Conservation Corporation initiated studies to determine the status of this species in Saskatchewan. The results of this study revealed that populations in Saskatchewan were much higher than previously thought and that this species was not restricted to native prairie habitat because it appeared to respond to vegetation structure rather than species composition (Davis *et al.* 1996). This species was de-listed by COSEWIC in 1996. The Baird's sparrow still faces imminent extirpation or extinction in Manitoba and is regarded as endangered by the Manitoba Department of Natural Resources. Therefore, it is still a species of concern in Manitoba, which represents the northeastern range limit for this species in Canada (Godfrey 1986).

Smith (1996) indicates that this species occurs as a possible breeding species in the vicinity of Yorkton, Foam Lake, and Preeceville, and that the UARB may include the northeastern limit of this species' Saskatchewan breeding range. Therefore it is likely rare to uncommon in grasslands within the Saskatchewan portion of the UARB and rare in Manitoba portions.

4.8 Northern leopard frog



Bill Preston

Northern Leopard Frog

The northern leopard frog is widely distributed from south central Northwest Territories to California in the west, southern New Mexico in the south, and through the northern plains to New England, Quebec and the maritime provinces of eastern Canada (Russell and Bauer 1993).

The northern leopard frog was designated as vulnerable by COSEWIC in 1998 (COSEWIC, 1998). A vulnerable species is defined as a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. There are no listings for this species at the Manitoba Conservation Data Centre or the Saskatchewan Conservation Data Centre.

Northern leopard frog populations have decreased across Canada since the late 1970's (Russell and Bauer 1993), although the reasons are unknown. They have numerous mammalian and avian predators such as mink, raccoon, skunk, weasels, herons, bitterns, pelicans, and kingfishers. They are also susceptible to drought that causes their wetland habitats to dry out, leaving frogs attempting to hibernate in these areas vulnerable to freezing. These frogs occupies wet woods, grasslands with adequate cover, and a variety of wetland types throughout the UARB but probably has a very localized distribution (Andy Didiuk, *pers. comm.*).

4.9 Monarch Butterfly

This migratory butterfly occurs throughout southern Canada from British Columbia to Newfoundland. They likely arrive on the prairies at the end of May and early June and build up their populations through several generations before leaving in early September (Layberry *et al.* 1998). Populations vary widely depending on weather and survival rate, usually peaking in summer before their migration to Mexico where they overwinter *en masse* in the oyamel fir forests in the mountains west of Mexico City (Brower 1995). Feeding exclusively on a variety of milkweed species, monarchs ingest toxins within milkweed which gives them an unpleasant taste that is unpalatable to predators.

Keith Hobson

Monarch Butterfly

The monarch butterfly was designated as vulnerable by C.O.S.E.W.I.C. in 1998 (COSEWIC 1998). This designation is defined as a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

Within the UARB, these butterflies are most likely found in moist riparian valley bottoms that either support milkweed or have it growing in adjacent areas. Since this species is migratory, however, it may be observed almost anywhere during its migration.

4.10 Rare Plants

Harms *et al.* (1992) list thirty-one plant species designated as rare in Saskatchewan (Table 5) according to criteria listed in Rare and Endangered Native Vascular Plants of Saskatchewan (1992). A provincially rare species is one that has a small provincial overall population and is highly susceptible to human alterations to its environment. These typically exist in low numbers and/or in highly localized geographical areas. Manitoba Conservation Data Centre and Saskatchewan Conservation Data Centre have an S1 designation for species that are very rare throughout their range (critically imperiled) and an S2 designation (imperiled) for species that are rare throughout their range. These species are denoted in Table 5. None of the rare plants designated as endangered or threatened by the Manitoba Department of Natural Resources and Saskatchewan Environment and Resource Management are found in the UARB. Distribution maps for all rare plants listed in Table 5 are provided in Appendix 7.

Table 5: Rare plants and their corresponding statuses as designated by Harms *et al.* (1992), Saskatchewan Conservation Data Centre (SCDC) and Manitoba Conservation Data Centre (MCDC).

SPECIES	HARMS	MCDC	SCDC
Andromeda glaucophylla	✓		
Antennaria neodioica	✓		
Aster umbellatus var. pubens	✓		
Botrychium minganense	✓		
Carex granularis	✓		
Carex normalis		✓	
Carex raymondii		✓	
Carex sterilis		✓	
Carex tetanica	✓		
Castilleja coccinea	✓		
Cirsium drummondii			✓
Corispermum nitidum	✓		
Crataegus succulenta	✓		
Cypripedium calceolus var. pubescens	✓		
Cypripedium reginae	✓		
Dichanthelium leibergii	✓		
Dichanthelium wilcoxianum		✓	
Eleocharis compressa	✓		
Elymus glaucus	✓		✓
Eriophorum callitrix		✓	
Euphorbia geyeri		✓	
Gentiana andrewsii var. *dakotica*			✓
Hypoxis hirsuta	✓		✓
Liparis loeselii	✓		
Listera borealis	✓		
Malaxis monophyllos var. brachypoda	✓		
Malaxis paludosa	✓		
Muhlenbergia andina		✓	
Oryzopsis canadensis		✓	
Oryzopsis hymenoides		✓	
Panicum virgatum	✓		
Panicum wilcoxianum		✓	
Parnassia glauca	✓		
Pinguicula vulgaris	✓		
Polygonum scandens	✓		
Prenanthes alba	✓		
Primula mistassinicia		✓	
Rhynchospora capillacea	✓	✓	
Rhynchospora capillacea	✓		
Rosa blanda	✓		
Sambucus racemosa ssp. *pubens*	✓		
Stipa richardsonii	✓		
Streptopus amplexifolius var. americanus	✓		
Teucrium canadense var. occidenale	✓		✓
Viola incognita	✓		

5.0 FEATURE SPECIES

Feature species include those that may not be presently at risk, however they are of concern and are sometimes monitored due to their specific habitat associations or highly localized distributions and/or breeding locations, should be monitored with concern. Colonial-nesting birds, for example, have very localized breeding locations that are vulnerable to both natural and human-related disturbance.

5.1 Great Blue Heron

This species occurs across southern Canada and the rest of North America and winters from southern British Columbia and the northern United States south to Panama, Columbia, and Venezuela (Godfrey 1986). It is a fairly common summer resident throughout the southern half of Saskatchewan (Smith 1996) and Manitoba. Herons are often seen along permanent watercourses such as creeks and rivers in search of fish and less frequently in the vicinity of other less permanent waterbodies where small rodents, amphibians, and snakes are taken as prey. Because of their disposition for fish, they forage widely, often far from the nesting location. Great blue herons build their bulky nests high up in trees in colonies that can contain up to 75 nests, although the average colony size in Saskatchewan is around 27 nests (Smith 1996).

J. Tallosi

Great Blue Heron

Known great blue heron colonies in the UARB are summarized in Table 6. Large colonies located on Horseshoe Lake, north of Yorkton, and near Fishing Lake, have contained in excess of 50 nests in a single breeding season (Vermeer and Anweiler 1970). The Horseshoe Lake colony was abandoned in the early 1990's and no longer exists (Bill Anaka, *pers. comm.*). Heron colonies are very sensitive to human disturbance, and often abandon their nests if disturbed. They are also vulnerable to high winds that may blow nests or young down to the ground, and to marauding raccoons that climb nest trees to gain access to the eggs and/or young.

Table 6: Great blue heron colonies in the Upper Assiniboine River Basin

LOCATION	NUMBER OF NESTS	YEAR	REFERENCE
Leech Lake, SK	2	1944	Houston (1949)
Fishing Lake, SK	50-60	1979	A. R. Smith *pers. comm.*
Ebel Lake, SK	8-10	1980	A. R. Smith *pers. comm.*
Horseshoe Lake, SK	50 20 35 10-15	1970 1975 1979 1984	Vermeer and Anweiler (1970) A. R. Smith *pers. comm.* A. R. Smith *pers. comm.* A. R. Smith *pers. comm.*
Rousay Lake, SK	5	1985	A. R. Smith *pers. comm.*
Bone Lake, SK	31	1994	A. R. Smith *pers. comm.*
Blackbird Creek, SK	9	1998	B. Collins, *pers. comm.*
Lake of the Prairies, MB	31	1969	Vermeer and Hatch (1972)

5.2 Black-crowned Night Heron

This heron is found from southern Canada through to the West Indies, Central and South America to northern Chile and Central Argentina (Godfrey 1986). It nests in seasonal and semi-permanent marshes with abundant emergent growth, or in adjacent stands of trees, and it forages in a variety of wetland types (Davis 1993). Night herons also forage widely from their breeding locations to feed on fish, amphibians, small snakes, and a variety of invertebrates. Their bulky nests are built in extensive stands of emergent growth, or in woods adjacent to wetland habitat.

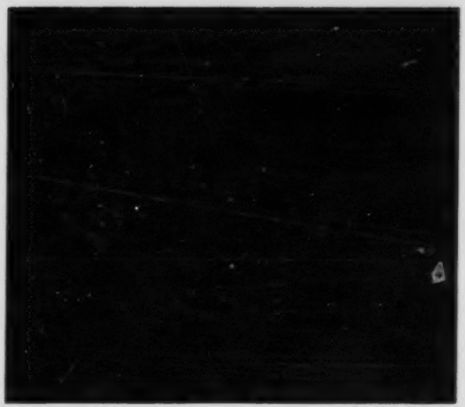
Man. Dept. Natural Resources

Black-crowned Night Heron

Night herons have traditionally nested on the west side of Upper Rousay Lake, south of Yorkton (Houston 1949). Nesting was first documented there in 1941 on an island in the lake, and later they alternated this site with a stand of poplars and willows on the west side of Rousay Lake. It appears that this species still regularly breeds in this area. Night herons were frequently observed on York Lake, Upper and Lower Rousay Lake and Little Leech Lake during the summer of 1973. Although no nests were found they were probably nesting in the vicinity (Schmidt 1973). A group of 25 night herons that appeared to be building nests at Rokeby marsh in May of 1993 later abandoned the site (Dale Hjertaas, *pers. comm.*). Night herons are still believed to be breeding at this location (Rob Kirkness, *pers. comm.*).

5.3 American Bittern

The American bittern is found throughout most of Canada south of the treeline south to California, Texas, Missouri, and Maryland, and it winters in the central and southern United States (Godfrey 1986). More often heard than seen, this secretive heron inhabits a variety of wetland types that contain extensive emergent stands of cattail and bulrush where it patiently stalks passing prey that includes fish, amphibians, crayfish, and insects. Its guttural pumping song has earned this bird the nickname of "slough pump".



Lorne Colpitts

American Bittern

Bittern populations have recently been declining in Saskatchewan, along with much of the rest of North America. This is largely due to the loss and degradation of wetland habitats, and the vulnerability of prey items to agricultural pesticides (Gibbs *et al.* 1992). The bittern is still a widespread breeding species in the UARB (Smith 1996). The presence of this species at larger wetlands such as Horseshoe Lake (Hjertaas 1975), Barvas Marsh (Kornder 1994) and wetland complexes south of Yorkton (Schmidt 1973) suggest that it may be locally common in these areas. Breeding Bird Survey data from Smith (1996) indicates that American bitterns have decreased at a highly significant rate (-3.8 %) on Saskatchewan survey routes between 1968 and 1992.

5.4 Sandhill Crane

Sandhill cranes breed from Arctic Canada and Alaska south locally to northeastern California, Nevada, Wyoming, Colorado, South Dakota and Michigan, as well as southern Mississippi to Florida and Cuba (Godfrey 1986). Most winter in the southern United States.

Canadian Wildlife Service

Sandhill Crane

Unlike its larger relative, the whooping crane, the sandhill crane is still a common bird. Large, spiralling flocks of arctic-bound cranes travel through the prairies in the spring and fall on their way to and from tundra wetlands where they breed. Southern populations formerly bred in the large marshes and wetland complexes throughout the parklands and prairies. Their breeding range was fragmented considerably following settlement due to intensive agricultural activities and it is now a rare and local breeding species in these regions (Smith 1996).

Historic evidence indicates that this species was once a common breeding species within the UARB, as illustrated by an unusual concentration of breeding sandhill cranes documented in 1893 through a search by a local resident of a small marshy ravine near the present village of Willowbrook, Saskatchewan. This ravine, although only 1.5 miles long by 200 yards wide, contained ten crane nests, each with two eggs (Houston 1949). With the recent trend in rural depopulation, cranes seem to be slowly reoccupying suitable wetland habitats throughout the parklands of Saskatchewan, including the UARB. This was evident in the Rokeby Marsh area in 1996 when six sandhill crane nests were found (Burke 1996). In addition, the presence of sandhill crane flocks throughout the breeding season in these areas suggests that parkland populations of sandhill cranes are re-establishing themselves as a regular breeding species.

5.5 Yellow Rail

The yellow rail breeds from northern Canada from Alberta to Nova Scotia south to the northern United States, and it winters from Oregon to California and in the Gulf States (Godfrey 1986). This extremely shy and secretive bird is rarely seen due to its skulking nature and reluctance to fly. It is found in fens and sedge marshes overgrown or nearly overgrown with coarse vegetation. Its staccato clicking call notes are the best way to detect its presence.

Although widespread across the northern prairies and parkland regions of Saskatchewan, it is uncommon throughout its range (Smith 1996) and very little is known about its actual distribution in Saskatchewan. Its restricted habitat requirements make it vulnerable to drainage of temporary and seasonal wetlands that develop into suitable wet sedge meadow habitat. Recent surveys by Ducks Unlimited in the Barvas Marsh complex east of Yorkton found this species to be present throughout the breeding season (Kornder and Belcher 1996), which suggests that it may be a locally distributed breeding species in wet sedge meadow habitat within the UARB.

5.6 Franklin's Gull

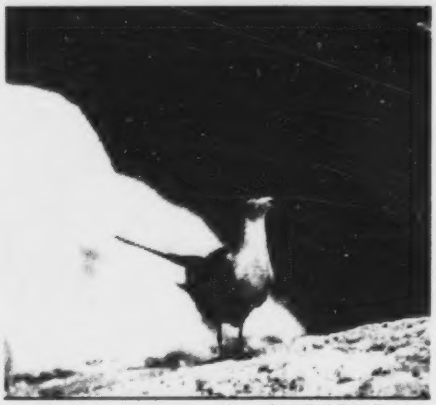
Canadian Wildlife Service

Franklin's Gull

This black-headed gull breeds in the prairie provinces of Canada south to north central United States, and it winters in the Pacific Ocean from Guatemala south to Chile (Godfrey 1986). It is a common summer resident throughout the southern half of Saskatchewan (Smith 1996). Like other gulls, it often follows farm equipment in search of exposed invertebrates.

Franklin's gulls are widespread as a summer resident throughout the Saskatchewan portion of the UARB but no nesting colonies are known (Smith 1996). Nesting in large semi-permanent marshes with plentiful emergent growth, these gulls construct platform nests of dead vegetation. Like other marsh-nesting birds, the localized breeding habitat of the Franklin's gull make it vulnerable to habitat loss through wetland drainage and habitat degradation resulting from drought.

5.7 Common Tern



Canadian Wildlife Service

Common Tern

The common tern breeds across Canada south of the treeline from Alberta to Newfoundland, south to the northern United States from Montana to New York and along the Atlantic coast to North Carolina. It winters from southern Baja California and South Carolina south to the Straits of Magellan of South America and Southern Africa (Godfrey 1986). This species nests singly or in colonies on islands and on barren sandy or rocky shoals in larger lakes and rivers (Smith 1996), often on the periphery of gull, pelican, and cormorant colonies.

The lack of suitable breeding habitat in the UARB limits the abundance of this species. Since fish are a highly preferred food, the best habitat for this species is likely associated with a few large, fish-inhabited lakes, such as Good Spirit Lake, and perhaps along the Assiniboine River and its adjacent wetlands. Although only one nest and one brood were located a colony discovered in 1955 at Good Spirit Lake, 70+ birds were observed in the vicinity which suggests that this area likely contained more nests (Anaka 1955). This species is still seen in the vicinity of Good Spirit Lake (Bill Anaka, *pers. comm.*) and likely nests at or near the lake. Otherwise, it is likely an uncommon migrant and summer resident, and a rare and very local breeding species in the UARB.

5.8 Forster's Tern

Canadian Wildlife Service

Forster's Tern

This tern breeds from the southern half of Alberta and Saskatchewan and southern Ontario south and southwest to include much of the southeastern and north central United States. It winters from central California to Guatemala and from Virginia to northern Florida and along the Gulf Coast States (Godfrey 1986). It prefers to nest in large deep-water marsh complexes. In these wetland habitats, terns nest in close proximity to one another on beds of emergent vegetation and occasionally on muskrat houses (Weller and Spatcher 1965). Large permanent wetlands and semi-permanent wetlands during years of high water levels may support small breeding populations of this tern if these wetlands, or adjacent ones, contains fish.

Like the common tern, a preference for fish as food is a limiting factor in their distribution within the UARB because of the relatively low number of lakes that contain fish and adequate marsh vegetation for nest sites. This species is more likely to breed in the UARB than the common tern. Forster's terns have been recently observed catching minnows at the south end of Good Spirit Lake and carrying them in a southeast direction, and breeding in this vicinity is likely (Bill Anaka *pers. comm.*).

5.9 Black Tern

The black tern breeds in marshes with abundant emergent growth throughout southern Canada and south to include most of the middle United States, wintering on the coasts of Panama to Peru and Surinam (Godfrey 1986). Its dependence on these marshes make it vulnerable to habitat alteration through drought and wetland drainage.

Canadian Wildlife Service

Black Tern

Black terns are much more widespread than other terns in the UARB because they feed on invertebrates that are plentiful in a variety of wetland types, rather than fish. Their nests are constructed on platforms of emergent vegetation in loose colonies. Breeding Bird Survey data from Smith (1996) indicates a significant downward trend (-5.6 %) on Saskatchewan survey routes between 1968 and 1992.

5.10 Yellow-throated Vireo

This vireo breeds throughout most of the eastern United States and southern Ontario, Quebec, and Manitoba and winters in South and Central Amercia (Rodewald and James 1996). It favors edge habitats within open stands of mature deciduous trees along streams, roads and urban areas (Godfrey 1986; Rodewald and James 1996). In Manitoba it especially favors riparian areas that have scattered large deciduous trees over an understory that is not dense above the shrub layer (Bill Koonz *unpubl. data* 1993).

Canadian Wildlife Service

Yellow-throated Vireo

Yellow-throated vireo surveys were conducted in Aessippi Provincial Park during the summer of 1993 to assess the possible effects of the construction of a proposed ski hill on wildlife populations. These surveys determined that this vireo was a rare and very local species in suitable woodland habitat within most of the park. The exception was in the actual area of the proposed ski hill where yellow-throated vireos were recorded "in large numbers during 1992 surveys" (Bill Koonz *unpubl. data 1993*). The lack of these vireos in similar habitat adjacent to the park suggests that this population is very localized and it would be extremely vulnerable to habitat alteration due to the development of this resort. This population likely represents the northwest limit of this species' range. Isolated populations of yellow-throated vireos may exist in suitable habitat further upstream along the

Assiniboine River. The specific habitat requirements of this species combined with the fact that it is at or near the northwest limit of its range make it extremely vulnerable to habitat alteration that reduces the quality of breeding habitat and increases the ability of brown-headed cowbirds to parasitize its nests.

5.11 Golden-winged Warbler

Canadian Wildlife Service

Golden-winged Warbler

The golden-winged warbler breeds in the northeastern and northcentral United States, southern Ontario, southern Manitoba and rarely in Saskatchewan (Curson *et al.* 1994; Godfrey 1986). They winter in Central America and northern South America (Confer 1992, Dunn and Garrett 1997). This species requires regenerating old pastures and fields, gaps in deciduous forest, shrubby regrowth, and edges along streams (Confer and Knapp 1981, Curson *et al.* 1994) and appears to favor the early stages of regeneration within these habitats and once that stage is past, abandon the area (Confer and Knapp 1981). Golden-winged warblers have declined in the southern portion of their range due to habitat loss, hybridization with the closely related blue-winged warbler, and nest parasitism from brown-headed cowbirds (Confer 1992, Gill 1997). This species' breeding range, however, has recently been expanding to the northwest, and their breeding range appears to be shifting northward (Price *et al.* 1995, Dunn and Garrett 1997).

Wally (1973) considered them uncommon and probably breeding in suitable habitat in Riding Mountain National Park that borders the UARB east of Shellmouth, Manitoba. Three possible breeding records are from the Saskatchewan side of Duck Mountain Provincial Park (Smith 1996), a portion of which is encompassed within the northeastern region of the UARB.

A study was conducted during the summer of 1998 in the Duck Mountain, Riding Mountain, and Porcupine Hills areas of Manitoba and Saskatchewan "to obtain a better understanding of the extent of golden-winged warbler populations in this region, especially in light of current and projected forest harvesting on the Louisiana Pacific Forest Management Area" (Cumming 1998). Although only a small portion of this region of the UARB was surveyed during this study, two golden-wings were observed on the southern slopes of the Duck Mountains (Enid Cumming, *pers. comm.*). The presence of shrubby habitat within the UARB on the northern and eastern slopes of the Lake of the Prairies drainage basin and along the Assiniboine River, and the fact that populations of golden-winged warblers in western Manitoba were larger than previously thought, suggests that the golden-winged warbler is more widespread in these areas than what current knowledge indicates (Enid Cumming, *pers. comm.*). Similar to the yellow-throated vireo, the specific habitat requirements of the golden-winged warbler and its occurrence at or near the northwest limit of its range make it vulnerable to any habitat alteration and particularly that which increases the ability of brown-headed cowbirds to parasitize its nests.

5.12 Red-sided Garter Snake

Man. Dept. Natural Resources

Red-sided Garter Snakes at a Hibernaculum

The red-sided garter snake is distributed from south central Northwest Territories and James Bay south to Florida and the Gulf Coast in the east, and southern California in the west (Russell and Bauer 1993).

They are widespread across parkland and forested areas of Saskatchewan while grassland populations are often scattered and local (Cook 1966). A variety of habitats are used by these snakes, but woodland habitats are favoured (Preston 1982). Garter snakes overwinter in communal dens known as hibernacula, usually located in cavities in the banks of streams and rivers, and often contain large numbers of snakes. Since large numbers of snakes congregate in these hibernacula, habitat alterations in their vicinity may have detrimental effects on the snake populations that use them.

6.0 Wetland Dynamics

Northern prairie wetlands play an important role in the life cycles of many terrestrial, aquatic and semi-aquatic wildlife species. Factors that determine the importance of wetlands as wildlife habitat include wetland size, structural diversity of vegetation, plant species diversity, salinity, land use in surrounding area, spatial distribution of wetlands, and water chemistry (Sather and Smith 1984). Wetland type has a large influence on food supplies for wildlife, and nutritional value and food availability have been shown to be important factors in determining food selection by waterfowl (Swanson and Duebbert 1989).

Wetland complexes that contain several different types of wetland vegetation will result in the availability of more ecological niches, which will benefit a broader diversity of wildlife species. Wetlands often contain more than one zone of characteristic wetland vegetation according to water permanence. These zones typically form rings of different vegetation proceeding from the wetland periphery to the central zone along an elevation and moisture gradient. Plant species diversity is highest in the peripheral wet meadow zone, and decreases with water permanence (van der Valk and Davis 1978).

Temporary wetlands consist of a wet meadow vegetation zone. Seasonal wetlands have a central area of shallow marsh vegetation and often have a peripheral wet meadow zone. Semi-permanent wetlands have a central area of emergent deep marsh vegetation that borders shallow marsh and wet meadow zones on the periphery. Permanent wetlands may have temporary, wet meadow and emergent deep marsh vegetation zones. If so a distinctive band of emergent deep marsh vegetation will be present in shallow waters on the outer edges and limited shallow marsh and wet meadow vegetation zones.

Aberrant patterns of zonation may result from periods of adjustment as vegetation adjusts to changes in environmental conditions (Kantrud, *et al.* 1989a). The number of zones present is dependent on the length of time that surface water is present (i.e. moisture regime). Each zone is dominated by different plant species assemblages that are indicative of each moisture regime (see Figure 4). These zones are dynamic in nature, often changing dramatically throughout the course of a season due to wet/dry water cycles that are ultimately the result of climatic variability.

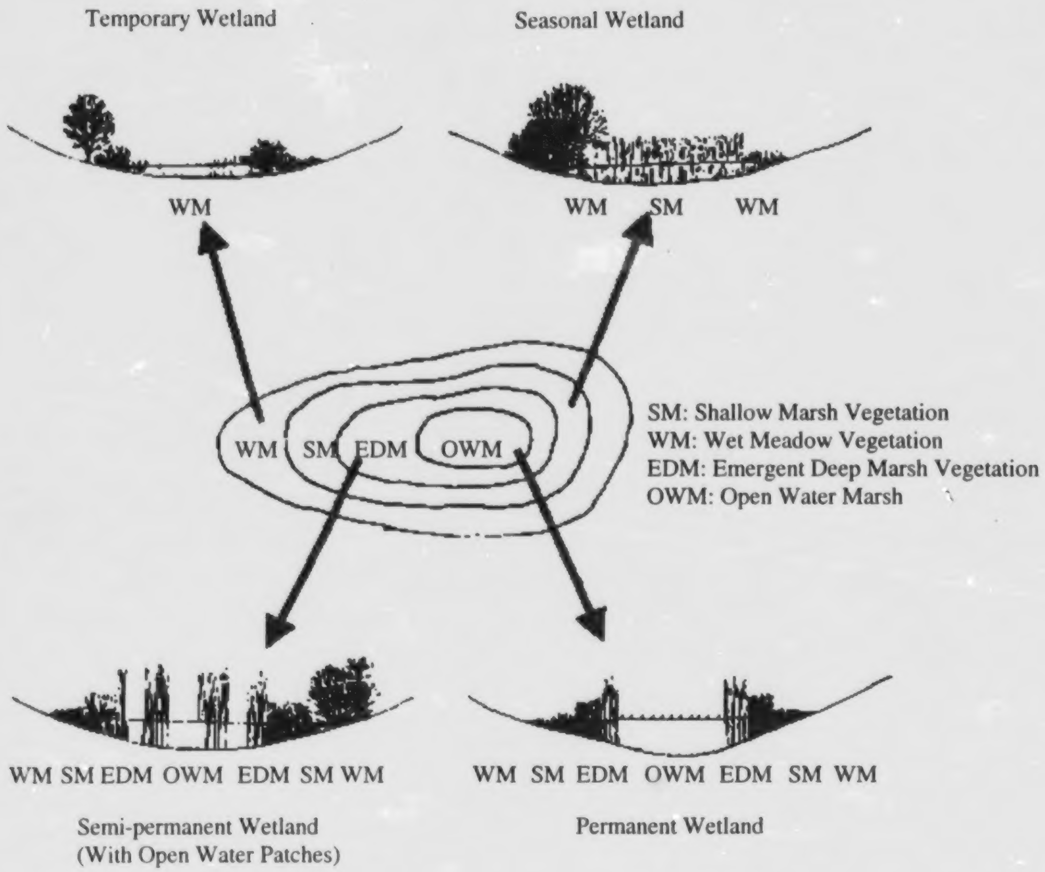


Figure 4: Wetland zonation in prairie wetlands (adapted from Millar 1976)

Changes in vegetation zonation due to changes in water permanence result in equally dynamic changes in wildlife use. There is often limited overlap in wetland use by closely related species of marsh-nesting birds such as marsh wren and sedge wren, Le Conte's sparrow and Nelson's sharp-tailed sparrow, and red-winged blackbird and yellow-headed blackbird (see Figure 5). This reduces competition for food and nest sites.

Seasonal changes in zonation are also important. Flooded wet meadows on the edges of semi-permanent wetlands may be used by foraging muskrats in early spring, but dry and develop into into lush grassy meadows by mid-summer which are used by skunks foraging for the nests of ground-nesting songbirds, such as the Le Conte's sparrow. As wetlands dry out they become less favourable for wildlife species that require wet meadow vegetation such as sedge wren, Le conte's sparrow, and meadow vole, and become more favourable for species that prefer drier meadows such as savannah sparrow, western meadowlark and thirteen-lined ground squirrel. Figure 6 illustrates how prairie rodents inhabiting wetland margins also select habitats that limits inter-specific competition for resources.

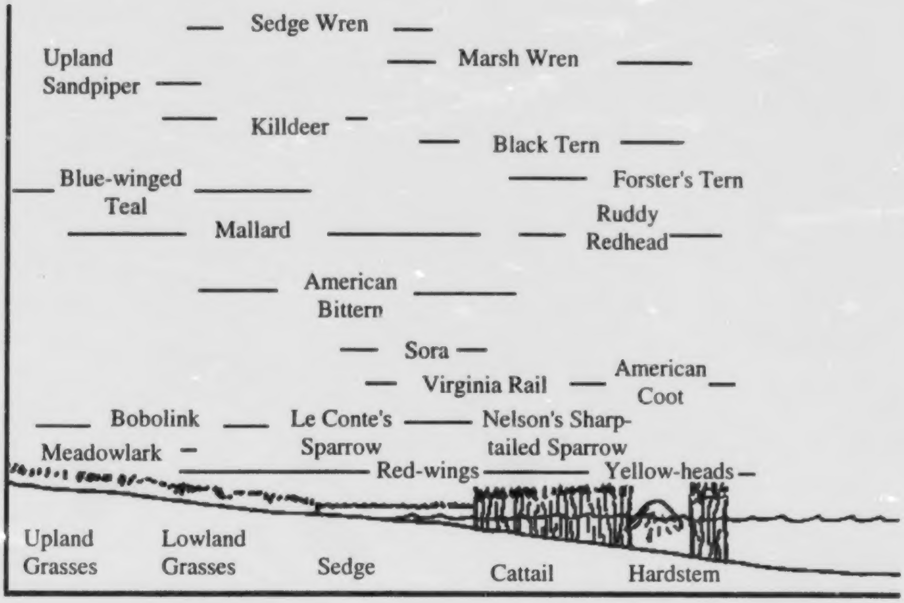


Figure 5: Use of different wetland zones by breeding bird species in prairie wetlands and associated uplands (adapted from Weller 1994)

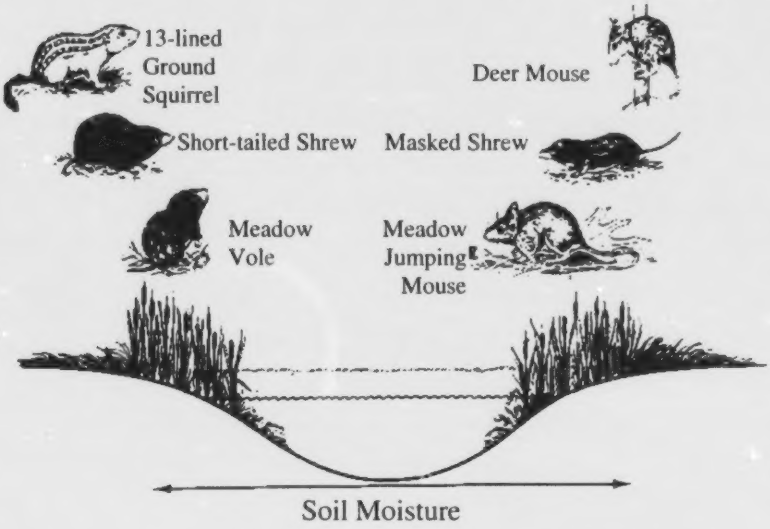


Figure 6: Distribution of small mammals in prairie wetlands (adapted from Pendleton 1984)

Salinity has a profound effect on the composition and distribution of wetland plant species in the prairie pothole region (Kantrud *et al.* 1989b). It is defined as an estimate of the concentration of total dissolved inorganic solids in water (milligrams/kilogram). Salinity levels are very dynamic and often vary considerably within seasons and between years, depending on climatic variability. As a general rule, salinity is at its lowest concentration in early spring because of dilution from spring runoff. Years with little runoff, however, can result in saline conditions early in the year. Salts usually become more concentrated as water levels decrease through the summer due to plant transpiration and evaporation, particularly in smaller wetlands.

Salinity is an important limiting factor in plant diversity and few plant species thrive under saline conditions. Some plants have evolved the ability to seasonally adjust to changes in salt concentration, while others are more dependent on a consistent source of groundwater (Meyboom 1967). High salinity levels inhibit seed germination of some species, but others vary in their ability to germinate at different salinity levels (Galinato and van der Walk 1986). Plants specially adapted to grow in saline conditions are known as halophytes. Some halophytes commonly found in this region include ditch grass, red samphire, and western sea-blite. Saline waters do not support a wide variety of aquatic life and are not as important to most wildlife species as other wetland types. These areas are, however, often frequented by large migrating flocks of arctic-nesting shorebirds in the spring and, if water is still present, in the fall as they migrate to and from their breeding grounds. The presence of protein-rich brine shrimp in these saline waters make them more attractive for these migrating shorebirds.

Wetlands are very dynamic ecosystems due to variation in spring runoff, amount of precipitation later in the year, evaporation caused by wind and high summer temperatures, plant transpiration, and wide climatic variability from year to year. These factors are linked to vegetation zonation and subsequent wildlife utilization. In order to be successful, wildlife species inhabiting prairie wetlands have co-evolved a high degree of adaptiveness along with their ever-changing wetland environment. Van der Valk and Davis (1978) outlined four idealized dynamic phases that prairie wetlands typically undergo in the course of a wet/dry cycle: dry marsh, regenerating marsh, degenerating marsh, and lake marsh (see Figure 7). These phases result in subsequent patterns of zonation of wetland vegetation. The dynamic nature of these alternating phases results in high productivity, whereas wetland stability reduces species richness (van der Valk and Davis 1980; Kantrud *et al.* 1989b). Cycles of drawdown and flooding rejuvenate wetlands, and increase biodiversity. While these phases are typical, many intermediate and partial phases can occur resulting in more complex zonation of wetland vegetation. The overall effects of these phases vary depending on the time of year and the speed at which they occur.

The dry marsh phase is characterized by a lack of surface water due to drawdown. This allows germination of pioneer species on the exposed wetland bottom and from seeds present in the seed bank, which consists of a variety of seeds stored in the substrate from emergent, submersed, and free-floating plants. Seeds may remain viable in the substrate from a few years to several decades, depending on the species (Walker 1959). The variety of seeds in the seed bank ensures that some type of vegetation will germinate regardless of what phase the wetland may be experiencing (Kantrud *et al.* 1989a). Seedlings of coarse emergents such as bulrush and cattail also establish themselves during this germination phase. Stands of dry emergents that may persist during this phase may continue to be used by red-winged blackbirds and small mammals such as voles and mice. Predators such as skunks, raccoons, weasels, northern harrier, and short-eared owl may search for prey in the vicinity of these stands. Most other wildlife species that occupy this habitat during phases of inundation will abandon these desiccated wetlands until the return of conditions that allow standing water. Many emergents require drawdown and often disappear after drying, and return following subsequent reflooding (regenerating marsh phase), therefore drawdown is crucial for re-establishment of emergents after elimination during previous flooding.

Reflooding of the marsh due to precipitation and runoff results in the regenerating marsh phase. In this phase, annuals are drowned out and replaced by perennial emergents that have germinated from seeds or have reproduced via vegetative propagation. Wildlife diversity increases during this phase as the characteristic vegetation zones redevelop (Weller and Spatcher 1965). A more diverse vegetation structure within emergent stands increases the number of available niches for wildlife to utilize which results in an increase in the diversity of species. Trees that often grow on wetland perimeters are also vulnerable to drowning during prolonged flooding during this stage. Peripheral rings of trees and shrubs (both living and dead) provide excellent nesting and foraging habitat for many bird species.

The degenerative marsh phase follows continuous flooding which causes emergents to die off. Weller and Spatcher (1965) showed that maximum biodiversity occurs during this phase due to the variety of habitats that result from the contrast of open water and emergent vegetation. They determined that marsh-dependent bird species are at maximum or near-maximum diversity and production during this phase with American bitterns, rails, black terns, marsh wrens, red-winged blackbirds, and yellow-headed blackbirds uniformly distributed in the structurally diverse emergent cover. Diving waterbirds such as grebes, diving ducks and coots that are very plentiful in the open water zones also nest in this emergent vegetation. Muskrat populations are well distributed and usually approach the carrying capacity of the wetland during this phase. Predators such as coyote, fox, mink, skunk, raccoon, birds of prey, reptiles, and amphibians, are all attracted to wetland perimeters due to plentiful prey. Voigts (1976) also found the greatest diversity of nesting birds occurred during this phase and suggested this was because the largest number and greatest diversity of aquatic invertebrates seem to be produced during this phase when open water habitats with plentiful submerged vegetation are interspersed with the stands of emergents.

Once persistent levels of high water have eliminated the emergent vegetation and prevented the germination of seedlings, the wetland enters the lake marsh stage in which submersed vegetation predominates. Biodiversity decreases during this phase because of the abundance of open water and very little, if any, emergent vegetation (Weller and Spatcher 1965). Some muskrats and diving waterbirds may still be present, and perhaps red-winged blackbird if there is some remaining emergent growth. Species that depend on extensive emergent stands, such as those mentioned in the degenerative phase, must relocate to more suitable habitat during this phase. This phase will persist until drought or drawdown causes the wetland to dry out and return to the dry marsh phase.

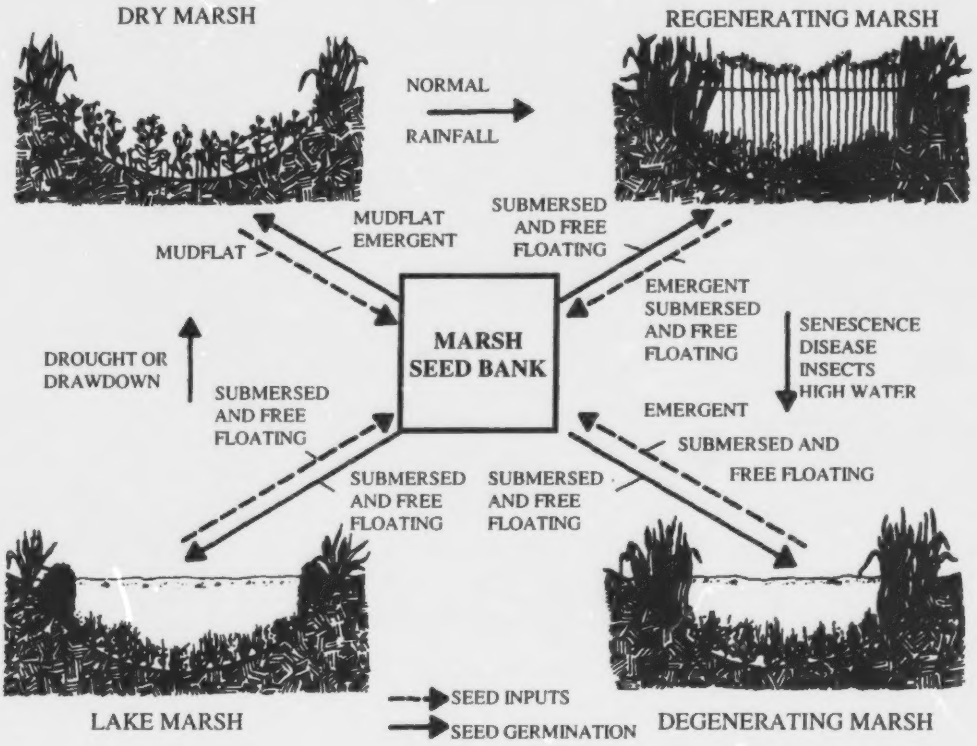

DRY MARSH
REGENERATING MARSH
NORMAL
RAINFALL
MUDFLAT
MUDFLAT EMERGENT
SUBMERSED AND FREE FLOATING
EMERGENT SUBMERSED AND FREE FLOATING
MARSH SEED BANK
DROUGHT OR DRAWDOWN
SENESCENCE DISEASE INSECTS HIGH WATER
SUBMERSED AND FREE FLOATING
EMERGENT
SUBMERSED AND FREE FLOATING
SUBMERSED AND FREE FLOATING
SUBMERSED AND FREE FLOATING
LAKE MARSH
SEED INPUTS
SEED GERMINATION
DEGENERATING MARSH

Figure 7: A generalized vegetation cycle in a prairie wetland (adapted from van der Valk and Davis, 1978.

7.0 Wildlife Movements and Responses to Changing Habitat

7.1 Basin wetlands

Evidence indicates that the lake marsh phase of basin wetlands resulting from stabilized high water levels decreases biodiversity (Weller and Spatcher 1965). Therefore, wetland instability due to periodic drying and flooding results in very dynamic changes in use by wetland wildlife species. American coots and yellow-headed blackbirds in regions further south have been known to defer nesting during sub-optimal lake marsh phases until later in the season when conditions return to a more favorable condition (Weller 1994). In a northern prairie climate that has a relatively short breeding season, however, this strategy may not be effective. Semi-aquatic mammals must be mobile in response to changes in their wetland habitat. Muskrats and mink that inhabit temporary and seasonal wetlands must abandon these areas (and semi-permanent wetlands during drought years) as they dry out through the course of the warmer months and move to wetlands with deeper water that will contain the resources they need.

The use of basin wetlands by wildlife in winter contrasts dramatically with summer use. Muskrats are in their lodges in permanent and deep semi-permanent wetlands, where they use plunge holes in their lodges to gain access to the aquatic vegetation below the ice. Dense stands of emergent vegetation often used as denning sites by skunks and raccoons in winter (Mutch 1977) are important in winter survival of these species in northern latitudes (Fritzel 1989). Small mammals such as voles, mice, and shrews are still active below the surface of the snow where they attract the attention of coyotes, red foxes, and weasels.

All marsh-nesting birds migrate south for the winter months due to their dependence on open water for production of food resources. These wetlands are essentially devoid of birds for nearly half of the year. Few other birds are attracted to basin wetlands in winter. The northern shrike breeds in subarctic regions of North America and winters in southern Canada and the northern United States (Godfrey 1986). These predatory songbirds are known to frequent stands of emergent vegetation in prairie wetlands during the winter, where they prey on shrews, voles, and mice. Occasionally, when rodent populations are up, the short-eared owl may attempt to overwinter in wetlands in the UARB. Northern leopard frogs and western painted turtles spend the winter hibernating at the bottom of the deeper basins, and in lakes and rivers (Preston 1982).

7.2 Riparian areas

Riparian ecosystems play a key role in the viability of wildlife species in the UARB, most of which utilize riparian areas at some point in their life cycle. One of the most important aspects of wildlife use of riparian zones is their role as corridors for the movement of wildlife species between habitats. Interconnected streams, creeks and rivers serve as distribution networks for wildlife species, allowing animals to move between habitats along sheltered pathways (Malanson 1993). This interchange mechanism is extremely important in the exchange of individuals between animal populations that inhabit different areas which promotes genetic exchange between populations of the same species (Malanson 1993). This is integral to the long term viability of individual animal species because it limits inbreeding within populations and allows species to continue evolutionary adaptations to their environment that are necessary for survival. These adaptations include resilience to disease and pestilence and the ability to adapt to a wide range of environmental conditions.

Another major function of connecting corridors of habitat is their role in the post-breeding dispersal of wildlife. Upon reaching maturity, the juvenile cohorts of many riparian-breeding species must leave their natal territories and seek out new habitats in which to establish territories of their own. Mink, for example, commonly inhabit creeks and rivers. Young that are born in the spring and raised in their mother's territory along a river or creek are forced to disperse in autumn (Pattie and Hoffmann 1992). Vegetated riparian corridors provide sheltered pathways for these juveniles to follow until they are able to find an unoccupied territory.

The connectivity of riparian areas allows animals that require the use of different habitats at different times of the year the ability to move between them safely. An example of this is the western painted turtle that spends most of its time basking on rocks and logs in slow-moving creeks and a variety of wetland types. During the breeding season, however, post-breeding females must seek out sandy soils in upland areas in which to bury their eggs. This often requires individuals to travel along or away from riparian habitat by way of these sheltered corridors.

Riparian habitat along streams with intermittent flow are often more sparsely vegetated than those with permanently flowing water. These corridors often connect areas that contain more suitable wildlife habitat. Therefore, sparsely vegetated riparian areas that seem devoid of wildlife are ecologically important to many wildlife species despite the fact that fewer species may actually dwell there for long periods of time.

The Upper Assiniboine River is unique in Saskatchewan because its headwaters form on the southern edge of the boreal forest and flows from northwest to southeast for nearly 1300 kilometres into southeastern Manitoba. This may be of importance in the migration patterns of the numerous species of neotropical songbirds that breed in the boreal forests of Saskatchewan and winter in tropical climates far to the south. Many of these warblers, vireos, thrushes and flycatchers appear to migrate into these forested regions of Saskatchewan from the southeast in the spring. Similarly they leave in the fall in a southeast direction en route to their tropical wintering grounds, largely bypassing the expansive prairies of western North America. While studies have indicated that migratory birds navigate using some type of internal compass, there is also evidence that topographical landmarks are used (Kerlinger 1995). The Assiniboine River may be important for this reason in that following it upstream leads directly into breeding habitat for many of these species. Birds following the Assiniboine and Shell Rivers from southern Manitoba during spring migration would arrive in boreal forest breeding habitat in the vicinity of the headwaters of these rivers. This may form the last leg of spring migration for many individuals of these species. In the fall, the reverse may occur with birds following the Assiniboine River valley in a southeast direction into southern Manitoba for the first leg of their southward migration. Many migrants traveling along these river corridors undoubtedly forage extensively within them in order to meet the rigorous physiological demands of migration.

Therefore, riparian corridors are very important pathways for a wide variety of wildlife species that must move about according to seasonal requirements associated with food availability, reproduction, and dispersal mechanisms.

8.0 Value of Wetlands – Ecological and Economical

8.1 Ecological Values of Wetlands

Sather and Smith (1984) summarized the major aspects of wetland ecological values. Prairie wetlands play a major role in flood control by absorbing and storing excess water temporarily during spring runoff and periods of high precipitation, and this surplus is then released slowly. The ability of a wetland to absorb excess water depends on its size, location within the drainage basin, substrate texture, and type of vegetation present. Surplus water can be drawn down into subterranean aquifers, which can recharge and rejuvenate water tables in some situations.

Basin wetlands are of immeasurable ecological value because of the roles they play in water purification, flow stabilization, flood control, and ground water recharging in some situations. Wetland vegetation reduces shoreline erosion due to its ability to stabilize substrates and trap sediments that adhere to vegetation or substrates. Vegetation structure dissipates wave and current energy, which in the prairie pothole region, can generate forceful wave action that is capable of significant shoreline erosion.

Basin wetlands are natural regulators of pollution through a variety of ecological processes. Aquatic plants and algae metabolize dissolved nutrients such as phosphates and nitrates aerobically through photosynthesis. Anaerobic conditions of the wetland bottom permit denitrification of soluble metals to insoluble forms and adsorption to surrounding sediments, which is crucial to the purification of water containing dissolved solids. Decomposers then break down these complex chemicals, or they are immobilized in sediments, in which case they don't disappear, but may be mobilized with disturbance.

Riparian wetlands are an ecologically unifying element in the landscape (Rabeni 1996). Like basin wetlands, they perform many important ecological functions. The dense root systems of riparian vegetation stabilizes the banks of creeks and rivers. Many herbaceous plants have extensive networks of roots and rhizomes that bind stream banks together, protecting them from scouring ice and fast-flowing runoff in early spring, or during periods of increased flow due to heavy precipitation later in the year. Sheltered banks and ravines along watercourses also regulate spring runoff by staggering the thawing of the winter snowpack. Dense riparian vegetation traps snow during the course of the winter, keeping it shaded as warm spring temperatures melt the snow in exposed areas. This results in the trapped snow melting at a much slower rate, which increases the amount of water that is able to soak into the substrate. This increases soil moisture rather than adding to the runoff from exposed snow and increasing the chance of erosion. Elmore and Seschta (1987) demonstrated that water regulation by riparian wetlands helps sustain water flow later in the season, recharge aquifers, and control runoff.

Vegetation growing on the banks of streams and rivers act as water purifiers both by directly filtering out both man-made and natural chemical impurities, and shading water which inhibits algae growth by lowering the water temperature. Riparian zones are important in nutrient recycling and nutrient storage, and denitrification in those soils prone to periodic flooding limits nutrients available to riparian plant species (Patrick *et al.* 1976). Lowrance *et al.* (1984) demonstrated that riparian zone vegetation can decrease pesticide and fertilizer movement into streams in areas of intensive agricultural use through uptake by vegetation and denitrification.

8.2 Economic Value of Wetlands

Many believe that wetlands are obstacles to economic development, however, in addition to the measureless economic value of the ecological processes previously described, wetlands are of considerable economic importance through both consumptive and non-consumptive outdoor recreational activities. Non-consumptive recreational activities associated with wetlands include camping, nature watching, sightseeing, boating, canoeing, picnicking, and photography. These activities contribute large amounts of capital to local communities.

Consumptive activities such as fishing and hunting depend on the health and viability of wetlands. Wetlands are prime waterfowl production areas that result in multi-level economic benefits through waterfowl hunting. Governments benefit through the sale of licenses, while local communities benefit through providing essential services to hunters and fisherman. The UARB has, for the most part, excellent capability for ungulate production although there are small pockets that have limitations (see Figure 8).

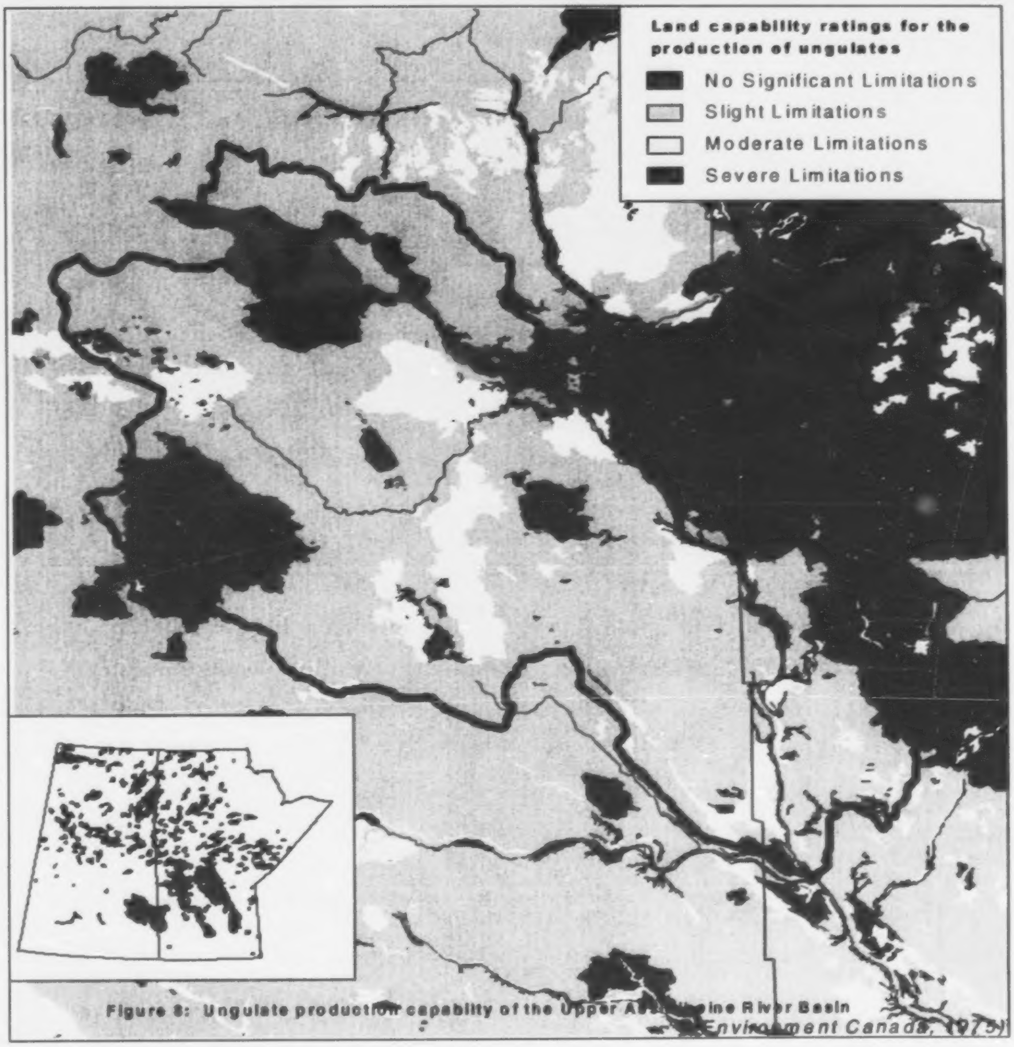

Land capability ratings for the production of ungulates
▇ No Significant Limitations
▨ Slight Limitations
☐ Moderate Limitations
▇ Severe Limitations

Figure 8: Ungulate production capability of the Upper Assiniboine River Basin
(Environment Canada, 1975)

Although approximately 85% of the Saskatchewan portion of the UARB lies within Wildlife Management Zones 37 and 39, small portions also extend into zones 35, 40, 48 and 56. White-tailed deer are the main big game species in these zones. The pre-hunting season population of white-tailed deer in the Saskatchewan portion of the UARB, based on population estimates from 1994 surveys, was approximately 17,000 (Adam Schmidt, *pers. comm.*). The five year average harvest between 1993-97 was 4177 deer which generated an average of 15,803 hunter days per year (Adam Schmidt, *pers. comm.*). Hunting by non-Saskatchewan residents in Wildlife Management Zone 48 in 1998 resulted in 114 hunters generating 550 hunter days (Al Arsenault, *pers. comm.*).

Moose and elk also occur in the Porcupine Forest along the northern edge of the UARB, southwest of Preeceville, Saskatchewan, and in the Beaver Hills near Parkerview, Saskatchewan (Adam Schmidt, *pers. comm.*). Population surveys in the vicinity of Duck Mountain Provincial Park in March of 1998 estimated that there were 307 moose (+/- 8%), and 217 elk (+/- 16%). Some moose and elk hunting is allowed in zones 37 and 48.

Many residents of the UARB obtain income from the trapping of commercially important fur-bearers such as mink, raccoon, beaver, and muskrat. A total of 147 trappers were active in zones 37, 39, and 48 during the 1998 trapping season (Al Arsenault, *pers. comm.*). Fur trapping in riparian areas can be profitable due to the attractiveness of this habitat to these commercial fur-bearing species.

Wetlands benefit farmers and ranchers by providing water for livestock, irrigation and domestic use. Vegetation of wetlands are often used as a source of wild hay for livestock. Ninety per-cent of Saskatchewan farms use wells for part of their water supply (Saskatchewan Wetland Conservation Corporation 1998). Many of these wells are dependent on rejuvenation from water collected in wetlands during spring runoff or periods of high precipitation. Agricultural benefits include quality forage and shelter for livestock, groundwater recharging that benefits both cereal and forage crops, and surface water for livestock, wells, and dugouts.

Stands of harvestable timber may be found in riparian areas and these can often be sustained indefinitely if managed properly. It has been shown that excessive removal of riparian timber increases downstream erosion due to increased flow rates (Cheng 1989). As a result, wetlands are clearly a very important, but often under appreciated contributor to our provincial and national economy.

8.3 Summary of Wetlands Values

Ecological

- Wetland vegetation regulates pollution by dissolving nutrients through photosynthesis and denitrification.
- Wetlands control flooding by absorbing water from spring runoff and excess precipitation, which also reduces erosion.
- In some situations, wetlands allow ground water recharging from water absorbed from wetlands into subterranean aquifers.
- Aquatic vegetation metabolize phosphates and nitrates and allow adsorption of insoluble metals to wetland substrates.
- Wetlands provide an abundance of wildlife habitat for many different species.

Economic

- Wetlands provide areas for livestock watering and wild hay production.
- Well water for many farm dwellings are dependent upon rejuvenation from water collected in wetlands during spring runoff and periods of excess precipitation.
- Riparian forests may provide opportunities for sustainable timber harvesting.
- Wetlands are of aesthetic importance which provide areas for recreational activities such as boating and fishing.
- Hunting, trapping and fishing in wetlands and wetland-associated habitats generate large amounts of income for UARB residents.

9.0 Conservation of Lands Important to Flora and Fauna

Wildlife is important to all Canadians. A Canada-wide survey on the importance of wildlife to Canadians conducted in 1991 showed that 86% of Canadian people believed it is important to maintain abundant wildlife, and 83% believed that it is important to protect endangered or declining wildlife (Statistics Canada 1991). A soon to be published report from similar surveys conducted in 1996 showed that 85% of Canadians, and 85% of Saskatchewan residents, participated in some wildlife-related activity during the year (Statistics Canada 1998). This study also determined that Saskatchewan residents spent nearly $388 million dollars on wildlife-related recreation in 1996. Therefore the direct and indirect benefits of wildlife, and hence wildlife habitat, clearly form an integral part of our daily lives as Canadians and as residents of Saskatchewan.

Numerous government agencies are involved with wetland conservation in Saskatchewan. Saskatchewan Environment and Resource Management protects Crown lands that are considered important for wildlife under *The Wildlife Habitat Protection Act*. These parcels are scattered throughout the province. In 1971, 56 hectares of Crown land at Horseshoe Lake were designated as a wildlife refuge to protect Canada geese and the great blue heron colony. In 1962, 1120 hectares of Crown land at Upper Rousay Lake were designated as a provincial game preserve to protect waterfowl by prohibiting hunting near the water's edge. This complimented the two thousand hectares of Crown land designated in 1948 at Upper Rousay Lake as a federal bird sanctuary to protect waterfowl (Jurick 1985).

The Saskatchewan Wetland Conservation Corporation has implemented a wetland policy to raise awareness of wetland benefits and ensure Saskatchewan's land use policies and programs include wetland conservation (Saskatchewan Wetlands Conservation Corporation 1998). This agency currently monitors lands along the Crescent Creek watershed to monitor water quality and provide landowners with land stewardship that benefit both the landowner and wildlife species that utilize this area. These measures include maintaining riparian habitat, seeding of forage crops, rotational grazing, and delayed haying of forage crops (Tom Harrison, *pers. comm.*). Similar plans are proposed for areas along the Whitesand River and Spirit Creek watersheds in the near future.

The North American Waterfowl Management Plan was initiated in 1986 in response to greatly reduced waterfowl populations and disappearing wetland habitat. It is a shared plan between Canada, the United States and, as of 1994, Mexico. The plan utilizes joint partnerships between government agencies, industry, sportsman's groups, conservation organizations and individual citizens to advance waterfowl conservation and contribute toward the preservation of all wetland-associated species. The plan implements programs that will conserve large acreages of wetland habitat by more intensive management of publicly owned lands, and by offering landowners financial incentives to manage lands in a way that is beneficial to waterfowl.

Non-government organizations such as Ducks Unlimited (Canada) have been important crusaders for the preservation and protection of wetlands. Its high profile status has done a great deal towards raising public awareness on the importance of wetlands. Incorporated in 1937 following the extreme droughts of the 1930's, Ducks Unlimited have been securing, enhancing, and managing waterfowl habitats through direct purchases, leases, and modified agricultural agreements that provide financial incentives for landowners to manage their land for wildlife. This includes preserving wetlands, discouraging overgrazing, and implementing delayed haying that allows bird species nesting in haylands to complete brood raising. Table 7 summarizes Ducks Unlimited projects within the UARB.

Table 7: Summary of Ducks Unlimited (Canada) projects within the Upper Assiniboine River Basin (M. Kornder, *pers. comm.*)

HABITAT ACRES	HABITAT TYPE	HABITAT TYPE DESCRIPTION
PURCHASE (105 PROJECTS)		
5226	Wetland	Small wetlands
9450	Planted cover	Seeded perennial grass, legume, shrub
12281	Existing cover	Aspen, shrubs, native and tame grasses, pasture, and hayland
Total **26944**		

HABITAT ACRES	HABITAT TYPE	HABITAT TYPE DESCRIPTION
LEASE (63 projects)		
2407	Wetland	Small wetlands
3681	Planted cover	Seeded perennial grass, legume, shrub
4287	Existing cover	Aspen, shrubs, native and tame grasses, pasture, and hayland
Total **10375**		
Modified Agriculture Projects (43 projects)		
2600	Wetland	Small wetlands
6109	Modified ag practices	Delayed hay cut on hay fields; conversion to forages - tame hay or clover
1600	Planned grazing	Systems that maximize wildlife benefits and sustainable pasture lands
Total **10309**		

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Appendix 1: Scientific names of mammal species mentioned in the text (after Pattie and Hoffmann, 1992)

COMMON NAME	SCIENTIFIC NAME
Masked Shrew	*Sorex cinerus*
Hayden's Shrew	*Sorex haydeni*
Montane Shrew	*Sorex monticolus*
Water Shrew	*Sorex palustris*
Arctic Shrew	*Sorex arcticus*
Pygmy Shrew	*Sorex hoyi*
Big Short-tailed Shrew	*Blarina brevicauda*
Little Brown Bat	*Myotis lucifugus*
Northern Myotis	*Myotis septentrionalis*
Long-eared Myotis	*Myotis evotis*
Western Small-footed Myotis	*Myotis ciliolabrum*
Silver-haired Bat	*Lasionycteris noctivagans*
Big Brown Bat	*Eptesicus fuscus*
Red Bat	*Lasiurus borealis*
Hoary Bat	*Lasiurus cinereus*
Snowshoe Hare	*Lepus americanus*
White-tailed Jackrabbit	*Lepus townsendii*
Least Chipmunk	*Tamias minimus*
Woodchuck	*Marmota monax*
Richardson's Ground Squirrel	*Spermophilus richardsonii*
Thirteen-lined Ground Squirrel	*Spermophilus tridecemlineatus*
Franklin's Ground Squirrel	*Spermophilus franklinii*
Red Squirrel	*Tamiasciurus hudsonicus*
Northern Flying Squirrel	*Glaucomys sabrinus*
Deer Mouse	*Peromyscus maniculatus*
Northern Grasshopper Mouse	*Onychomys leucogaster*
Southern Red-backed Vole	*Clethrionomys gapperi*
Heather Vole	*Phenacomys intermedius*
Meadow Vole	*Microtus pennsylvanicus*
Prairie Vole	*Microtus ochrogaster*

COMMON NAME	SCIENTIFIC NAME
Muskrat	*Ondatra zibethicus*
Northern Bog Lemming	*Synaptomys borealis*
Norway Rat	*Rattus norvegicus*
House Mouse	*Mus musculus*
Meadow Jumping Mouse	*Zapus hudsonius*
Western Jumping Mouse	*Zapus princeps*
Porcupine	*Erethizon dorsatum*
Beaver	*Castor canadensis*
Northern Pocket Gopher	*Thomomys talpoides*
Coyote	*Canis latrans*
Gray Wolf	*Canis lupus*
Red Fox	*Vulpes vulpes*
Black Bear	*Urus americanus*
Raccoon	*Procyon lotor*
Marten	*Martes americana*
Fisher	*Martes pennanti*
Ermine	*Mustela erminea*
Least Weasel	*Mustela nivalis*
Long-tailed Weasel	*Mustela freneta*
Mink	*Mustela vison*
Badger	*Taxidea taxus*
Striped Skunk	*Mephitis mephitis*
River Otter	*Lutra canadensis*
Lynx	*Felis lynx*
Elk	*Cervus elaphus*
Mule Deer	*Odocoileus hemionus*
White-tailed Deer	*Odocoileus virginianus*
Moose	*Alces alces*
Pronghorn	*Antilocapra americana*

Appendix 2: Scientific names of bird species mentioned in text (after American Ornithologists Union, 1998)

COMMON NAME	SCIENTIFIC NAME
Common Loon	*Gavia immer*
Pacific Loon	*Gavia pacifica*
Red-necked Grebe	*Podiceps grisegena*
Horned Grebe	*Podiceps auritus*
Eared Grebe	*Podiceps nigricollis*
Western Grebe	*Aechmophorus occidentalis*
Pied-billed Grebe	*Podilymbus podiceps*
American White Pelican	*Pelecanus erythrorhynchos*
Double-crested Cormorant	*Phalacrocorax auritus*
Great Blue Heron	*Ardeaa herodias*
Black-crowned Night Heron	*Nycticorax nycticorax*
American Bittern	*Botaurus lentiginosus*
Tundra Swan	*Cygnus columbianus*
Greater White-fronted Goose	*Anser albifrons*
Snow Goose	*Chen caerulescens*
Ross Goose	*Chen rossii*
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
Gadwall	*Anas strepera*
Northern Pintail	*Anas acuta*

COMMON NAME	SCIENTIFIC NAME
Green-winged Teal	*Anas crecca*
Blue-winged Teal	*Anas discors*
American Widgeon	*Anas americana*
Northern Shovelor	*Anas clypeata*
Wood Duck	*Aix sponsa*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Canvasback	*Aythya valisineria*
Lesser Scaup	*Aythya affinis*
Greater Scaup	*Aythya marila*
Common Goldeneye	*Bucephala clangula*
Bufflehead	*Bucephala albeola*
White-winged Scoter	*Melanitta fusca*
Surf Scoter	*Melanitta perspicillata*
Ruddy Duck	*Oxyura jamaicensis*
Hooded Merganser	*Lophodytes cucullatus*
Red-breasted Merganser	*Mergus serrator*
Common Merganser	*Mergus merganser*
Turkey Vulture	*Cathartes aura*
Northern Goshawk	*Accipiter gentilis*

COMMON NAME	SCIENTIFIC NAME
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Ferruginous Hawk	*Buteo regalis*
Rough-legged Hawk	*Buteo lagopus*
Red-tailed Hawk	*Buteo jamaicensis*
Broad-winged Hawk	*Buteo platypterus*
Swainson's Hawk	*Buteo swainsoni*
Golden Eagle	*Aquila chrysaetos*
Bald Eagle	*Haliaeetus leucocephalus*
Osprey	*Pandion haliaetus*
Gyrfalcon	*Falco rusticolus*
Prairie Falcon	*Falco mexicanus*
Peregrine Falcon	*Falco peregrinus*
Merlin	*Falco columbarius*
American Kestrel	*Falco sparverius*
Ruffed Grouse	*Bonasa umbellus*
Sharp-tailed Grouse	*Tympanuchus phasianellus*
Gray Partridge	*Perdix perdix*
Whooping Crane	*Grus americana*
Sandhill Crane	*Grus canadensis*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Yellow Rail	*Coturnicops noveboracensis*
American Coot	*Fulica americana*
Killdeer	*Charadrius vociferus*
Semipalmated Plover	*Charadrius semipalmatus*
Piping Plover	*Charadrius melodus*
American Golden Plover	*Pluvialis dominicus*
Black-bellied Plover	*Pluvialis squatarola*
Common Snipe	*Gallinago gallinago*
Upland Sandpiper	*Bartramia longicauda*
Spotted Sandpiper	*Actitis macularia*
Solitary Sandpiper	*Tringa solitaria*
Ruddy Turnstone	*Arenaria interpres*
Willet	*Catoptrophus semipalmatus*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Red Knot	*Calidris canutus*
Pectoral Sandpiper	*Calidris melanotos*
White-rumped Sandpiper	*Calidris fuscicollis*
Baird's Sandpiper	*Calidris bairdii*
Least Sandpiper	*Calidris minutilla*
Short-billed Dowitcher	*Limnodromus griseus*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Stilt Sandpiper	*Calidris himantopus*
Semipalmated Sandpiper	*Calidris pusilla*
Buff-breasted Sandpiper	*Tryngites subruficollis*
Whimbrel	*Numenius phaeopus*
Hudsonian Godwit	*Limosa haemastica*
Marbled Godwit	*Limosa fedoa*
American Avocet	*Recurvirostra americana*
Sanderling	*Calidris alba*
Red-necked Phalarope	*Phalaropus lobatus*
Wilson's Phalarope	*Phalaropus tricolor*
Herring Gull	*Larus argentatus*
California Gull	*Larus californicus*
Ring-billed Gull	*Larus delawarensis*
Franklin's Gull	*Larus pipixcan*
Bonaparte's Gull	*Larus philadelphia*
Caspian Tern	*Sterna caspia*
Forster's Tern	*Sterna forsteri*

COMMON NAME	SCIENTIFIC NAME
Common Tern	*Sterna hirundo*
Black Tern	*Chlidonias niger*
Rock Dove	*Columba livia*
Mourning Dove	*Zenaida macroura*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Great-horned Owl	*Bubo virginianus*
Snowy Owl	*Nyctea scandiaca*
Barred Owl	*Strix varia*
Long-eared Owl	*Asio otus*
Short-eared Owl	*Asio flammeus*
Northern Saw-whet Owl	*Aegolius acadicus*
Boreal Owl	*Aegolius funereus*
Common Nighthawk	*Chordeiles minor*
Ruby-throated Hummingbird	*Archilochus colubris*
Belted Kingfisher	*Ceryle alcyon*
Northern Flicker	*Colaptes auratus*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Hairy Woodpecker	*Picoides villosus*
Downy Woodpecker	*Picoides pubescens*
Black-backed Woodpecker	*Picoides arcticus*
Three-toed Woodpecker	*Picoides tridactylus*
Eastern Kingbird	*Tyrannus tyrannus*
Western Kingbird	*Tyrannus verticalis*
Great Crested Flycatcher	*Myiarchus crinitus*
Eastern Phoebe	*Sayornis phoebe*
Say's Phoebe	*Sayornis saya*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Alder Flycatcher	*Empidonax alnorum*
Willow Flycatcher	*Empidonax traillii*
Least Flycatcher	*Empidonax minimus*
Eastern Wood-Pewee	*Contopus virens*
Western Wood-Pewee	*Contopus sordidulus*
Olive-sided Flycatcher	*Contopus borealis*
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Bank Swallow	*Riparia riparia*
Barn Swallow	*Hirundo rustica*
Cliff Swallow	*Hirundo pyrrhonota*
Purple Martin	*Progne subis*
Gray Jay	*Perisoreus canadensis*
Blue Jay	*Cyanocitta cristata*
Black-billed Magpie	*Pica pica*
Common Raven	*Corvus corax*
American Crow	*Corvus brachyrhynchos*
Black-capped Chickadee	*Parus atricapillus*
Boreal Chickadee	*Parus hudsonicus*
White-breasted Nuthatch	*Sitta carolinensis*
Red-beasted Nuthatch	*Sitta canadensis*
Brown Creeper	*Certhia americana*
House Wren	*Troglodytes aedon*
Winter Wren	*Troglodytes troglodytes*
Marsh Wren	*Cistothorus palustris*
Sedge Wren	*Cistothorus platensis*
Gray Catbird	*Dumetella carolinensis*
Brown Thrasher	*Toxostoma rufum*
American Robin	*Turdus migratorius*
Hermit Thrush	*Catharus guttatus*
Swainson's Thrush	*Catharus ustulatus*
Gray-cheeked Thrush	*Catharus minimus*
Veery	*Catharus fuscescens*

COMMON NAME	SCIENTIFIC NAME
Eastern Bluebird	*Sialia sialis*
Mountain Bluebird	*Sialia currucoides*
Ruby-crowned Kinglet	*Regulus calendula*
Golden-crowned Kinglet	*Regulus satrapa*
American Pipit	*Anthus rubescens*
Sprague's Pipit	*Anthus spragueii*
Cedar Waxwing	*Bombycilla cedrorum*
Bohemian Waxwing	*Bombycilla garrulus*
Northern Shrike	*Lanius excubitor*
Loggerhead Shrike	*Lanius ludovicianus*
European Starling	*Sturnus vulgaris*
Yellow-throated Vireo	*Vireo flavifrons*
Blue-headed Vireo	*Vireo solitarius*
Red-eyed Vireo	*Vireo olivaceus*
Philadelphia Vireo	*Vireo philadelphicus*
Warbling Vireo	*Vireo gilvus*
Black and White Warbler	*Mniotilta varia*
Golden-winged Warbler	*Vermivora chrysoptera*
Blue-winged Warbler	*Vermivora pinus*
Tennessee Warlber	*Vermivora peregrina*
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
Yellow Warbler	*Dendroica petechia*
Yellow Warbler	*Dendroica petechia*
Magnolia Warbler	*Dendroica magnolia*
Cape May Warbler	*Dendroica tigrina*
Yellow-rumped Warbler	*Dendroica coronata*
Black-throated Green Warbler	*Dendroica virens*
Blackburnian Warbler	*Dendroica fusca*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Bay-breasted Warbler	*Dendroica castanea*
Blackpoll Warbler	*Dendroica striata*
Palm Warbler	*Dendroica palmarum*
Ovenbird	*Seiurus aurocapillus*
Northern Waterthrush	*Seiurus noveboracensis*
Connecticut Warbler	*Oporornis agilis*
Mourning Warbler	*Oporornis philadelphia*
Common Yellowthroat	*Geothlypis trichas*
Wilson's Warbler	*Wilsonia pusilla*
Canada Warbler	*WIlsonia canadensis*
American Redstart	*Setophaga ruticilla*
Scarlet Tanager	*Piranga olivacea*
House Sparrow	*Passer dometicus*
Bobolink	*Dolichonyx oryzivorus*
Western Meadowlark	*Sturnella neglecta*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Red-winged Blackbird	*Agelaius phoeniceus*
Baltimore Oriole	*Icterus galbula*
Brewer's Blackbird	*Euphagus cyanocephalus*
Rusty Blackbird	*Euphagus carolinus*
Common Grackle	*Quiscalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Indigo Bunting	*Passerina cyanea*
Evening Grosbeak	*Coccothraustes vespertinus*
Pine Grosbeak	*Pinicola enucleator*
Purple Finch	*Carpodacus purpureus*
House Finch	*Carpodacus mexicanus*
Pine Siskin	*Carduelis pinus*
American Goldfinch	*Carduelis tristis*
Hoary Redpoll	*Carduelis hornemanni*
Common Redpoll	*Carduelis flammea*
Red Crossbill	*Loxia curvirostra*
White-winged Crossbill	*Loxia leucoptera*
Spotted Towhee	*Pipilo maculatus*
Savannah Sparrow	*Passerculus sandwichensis*
Grasshopper Sparrow	*Ammodramus savanarrum*
Vesper Sparrow	*Pooecetes gramineus*
Lark Sparrow	*Chondestes grammacus*
American Tree Sparrow	*Spizella arborea*
Clay-coloured Sparrow	*Spizella pallida*
Chipping Sparrow	*Spizella passerina*
Dark-eyed Junco	*Junco hyemalis*
Harris Sparrow	*Zonotrichia querula*
White-crowned Sparrow	*Zonotrichia leucophrys*
White-throated Sparrow	*Zonotrichia albicollis*
Lincoln's Sparrow	*Melospiza lincolnii*
Swamp Sparrow	*Melospiza georgiana*
Song Sparrow	*Melospiza melodia*
Chestnut-collared Longspur	*Calcarius ornatus*
Lapland Longspur	*Calcarius lapponicus*
Snow Bunting	*Plectrophenax nivalis*

Appendix 3: Scientific names of reptile species in text (after Russell and Bauer, 1993)

COMMON NAME	SCIENTIFIC NAME
Western Painted Turtle	*Chrysemys picta bellii*
Red-sided Garter Snake	*Thamnophis sirtalis parietalis*
Western Plains Garter Snake	*Thamnophis radix*

Appendix 4: Scientific names of amphibian species in text (after Russell and Bauer, 1993)

COMMON NAME	SCIENTIFIC NAME
Boreal Chorus Frog	*Pseudacris maculata*
Northern Leopard Frog	*Rana pipiens*
Wood Frog	*Rana sylvatica*
Canadian Toad	*Bufo hemiophrys*
Tiger Salamander	*Ambystoma tigrinum*

Appendix 5: Scientific names of invertebrate species mentioned in text (after Clarke 1981)

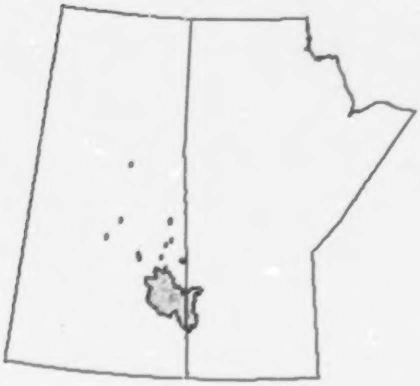
Common Name	Scientific Name
Three ridged mussel	*Amblema plicata*
Brine Shrimp	*Artemia salina*
Water strider	*Gerris remigis*
Water boatment	*Corixa spp.*
Black fly	*Simulium venustum*

Appendix 6: Scientific names of plant species mentioned in text (after Looman and Best 1979)

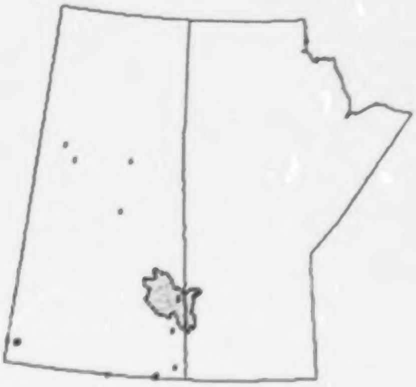
Common Name	Scientific Name
Alfalfa	*Medicago sativa*
Awned Sedge	*Carex antherodes*
Balsam Fir	*Abies balsamifera*
Balsam Poplar	*Populus balsalmifera*
Baltic Rush	*Juncus balticus*
Beaked Hazelnut	*Corylus cornuta*
Big Bluestem	*Andropogon gerardi*
Bishop's Cap	*Mitella nuda*
Black Spruce	*Picea mariana*
Blue Grama	*Bouteloua gracilis*
Broad-fruited Bur-read	*Sparganium eurycarpum*
BuffaloEberry	*Shepardia argentea*
Bunchberry	*Cornus canadensis*
Bur Oak	*Quercus macrocarpa*
Cattail	*Typha latifolia*
Chokecherry	*Prunus virginiana*
Cloudberry	*Rubus chamaemorus*
Common Reed Grass	*Phragmites australis*
Common Water-plantain	*Alisma plantago-aquatica*
Common Wintergreen	*Pyrola rotundifolia*
Creeping Juniper	*Juniperus horizontalis*
Creeping Spike-rush	*Eleocharis palustris*
Dewberry	*Rubus pubescens*
Dewberry	*Rubus pubescens*
Ditch Grass	*Ruppia maritima*
Early Yellow Locoweed	*Oxytropis macounii*
Feather Moss	*Pleurozium schreberi*
Fireweed	*Epilobium angustifolium*
Fowl Blue Grass	*Poa palustris*
Glaucous Grass-of-Parnassus	*Parnassia glauca*
Great Bulrush	*Scirpus validus*
Green Alder	*Alnus crispa*
Green Ash	*Fraxinus pennsylvanica*
Hairy Wild Rye	*Elymus innovatus*
Hawthorne spp.	*Crateagus spp.*
High-bush Cranberry	*Viburnum trilobum*
Hornwort	*Ceratophyllum demersum*
Jack Pine	*Pinus banksiana*
June Grass	*Koeleria gracilis*
Kalm's Lobelia	*Lobelia kalmii*
Kidney-leaved Violet	*Viola renifolia*
Knight's Plume	*Ptilium crista-castrensis*
Labrador Tea	*Ledum groenlandicum*
Little Bluestem	*Andropogon scoparius*
Little Club Moss	*Selaginella densa*
Manitoba Maple	*Acer negudo*
Milkweed spp.	*Asclepias spp*
Northern Bedstraw	*Gallium boreale*
Northern Reed Grass	*Calamagrostis inexpansa*

Common Name	Scientific Name
Ostrich Fern	*Matteuccia struthiopteris*
Oyamel Fir	*Abies religiosa*
Palmate-leaved Colts-foot	*Petasites palmatus*
Pasture Sage	*Artemisia frigida*
Pondweed	*Potamageton pusillus*
Prairie Bulrush	*Scirpus paludosus*
Prairie Crocus	*Anenome patens*
Prickly Rose	*Rosa acicularis*
Red Samphire	*Salicornia rubra*
Red-osier Dogwood	*Cornus stolonifera*
River Alder	*Alnus tenuifolia*
River Bulrush	*Scirpus fluviatilis*
Saskatoon	*Amelanchier alnifolia*
Shrubby Cinquefoil	*Potentilla fruticosa*
Slough Grass	*Beckmannia syzigachne*
Smartweed	*Polygonum coccineum*
Smooth Brome	*Bromus inermis*
Smooth Wild Strawberry	*Fragaria virginiana*
Sow-thistle	*Sonchus arvensis*
Spangletop	*Scolochloa festucacea*
Speargrass	*Stipa commata*
Star-flowered Solomon's Seal	*Smilacina stellata*
Swamp Birch	*Betula glandulosa*
Tall lungwort	*Mertensia paniculata*
Tall Manna Grass	*Glyceria grandis*
Tamarack	*Larix laricina*
Three-flowered Avens	*Geum triflorum*
Trembling Aspen	*Populus tremuloides*
Twinflower	*Linnaea borealis*
Twinflower	*Linnaea borealis*
Various-leaved Pondweed	*Potamogeton gramineus*
Veiny Meadow Rue	*Thalictrum venulosum*
Vine-leaved Colts-foot	*Petasites vitifolius*
Water-parsnip	*Sium suave*
Westerm Sea-blite	*Suaeda maritima*
Western Canada violet	*Viola rugulosa*
Western Snowberry	*Symphoricarpos occidentalis*
Wheatgrass spp.	*Agropyron spp.*
White Birch	*Betula papyrifera*
White Clover	*Trifolium repens*
White Spruce	*Picea glauca*
Wild Barley	*Hordeum jubatum*
Wild Gooseberry	*Ribes oxyacanthoides*
Wild Sarsaparilla	*Aralia nudicaulis*
Willow	*Salix spp.*
Wolf-Willow	*Eleagnus commutata*
Wood's Rose	*Rosa woodsii*
Woolly Sedge	*Carex lanuginosa*

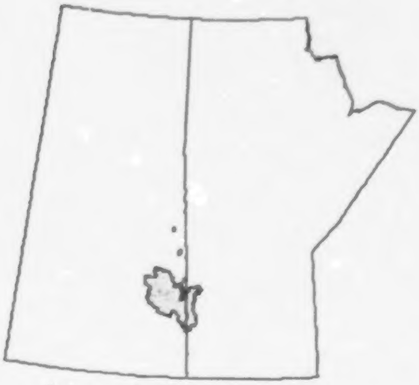
Appendix 7: Distribution maps for rare plant species occurring in the UARB



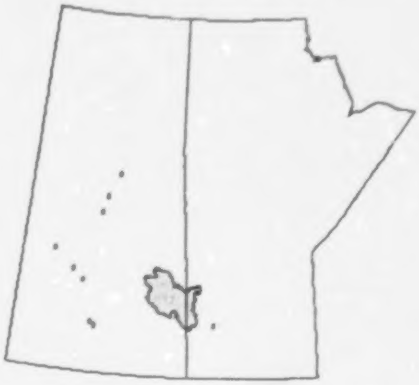
Andromeda glaucophylla



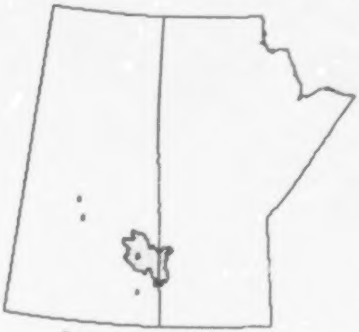
Antennaria neodiocia
(Common Pussy-toes)



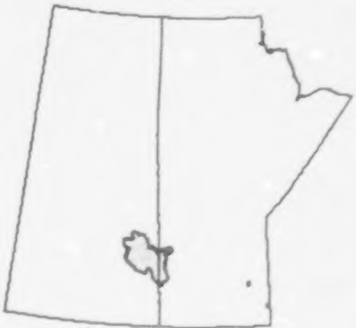
Aster umbellatus var. pubens
(Flat-topped White Aster)



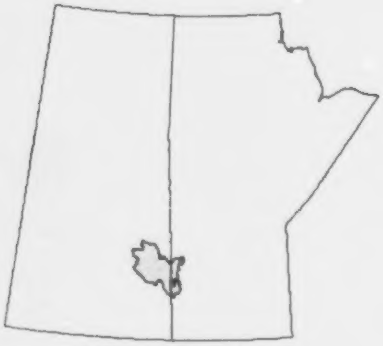
Botrychium minganense
(Mingan Moonwort)



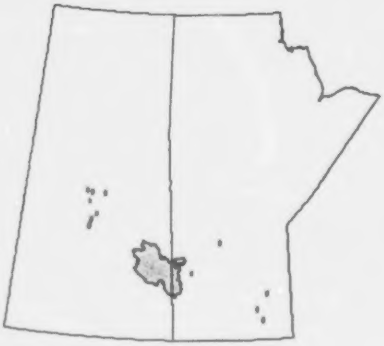
Carex granularis
(Granular Sedge)



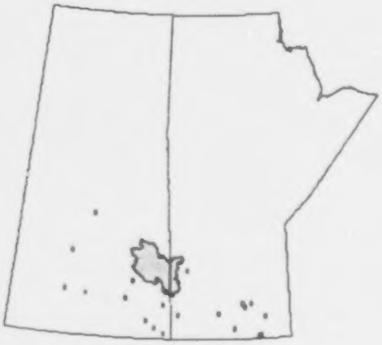
Carex normalis
(Larger Straw Sedge)



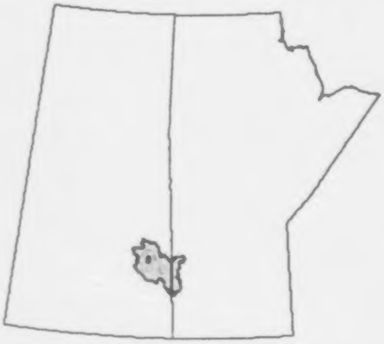
Carex Raymondii
(Black Sedge)



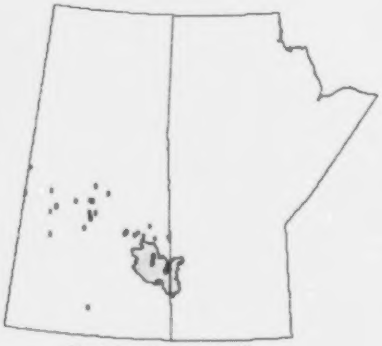
Carex sterilis



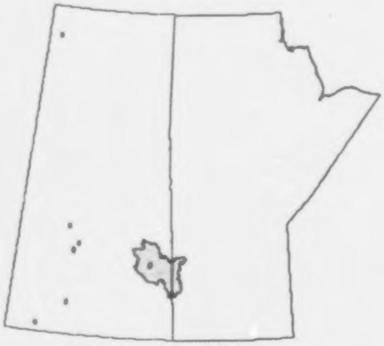
Carex tectanica
(Rigid Sedge)



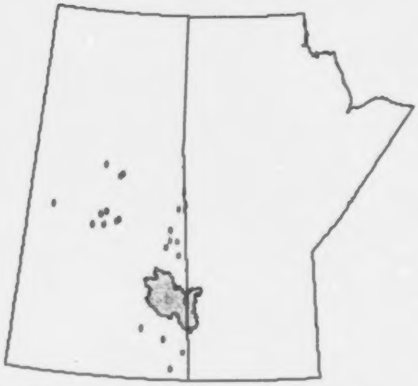
Castilleja coccinea
(Scarlet Paintbrush)



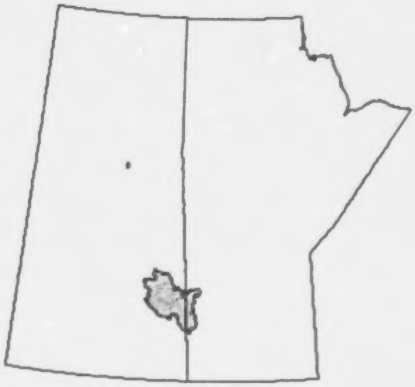
Cirsium drummondii
(Short Stemmed Thistle)



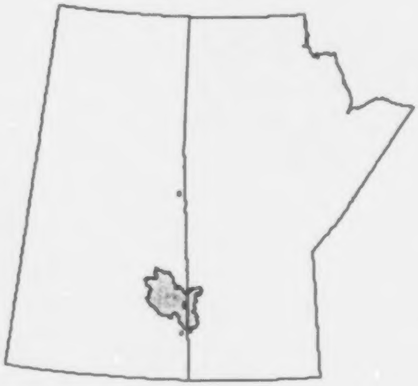
Corispermum nitidum



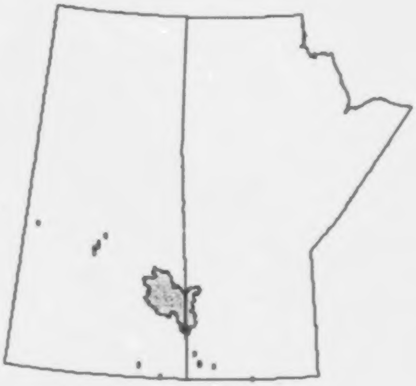
Cypripedium calceolus var. pubescens
(Yellow Lady's-slipper)



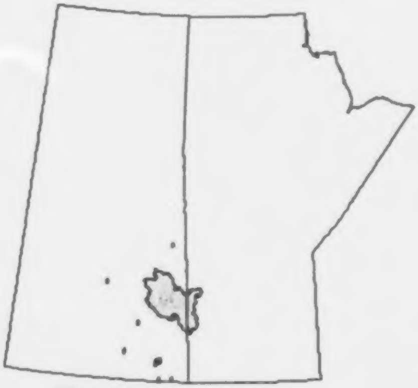
Cypripedium reginae
(Showy Lady's-slipper)



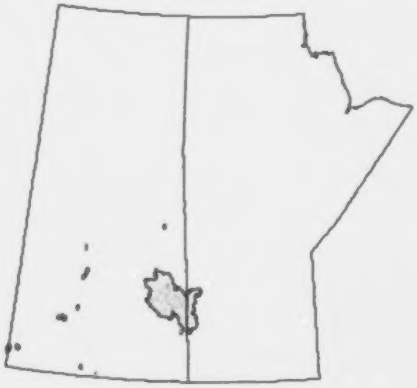
Dichanthelium leibergii



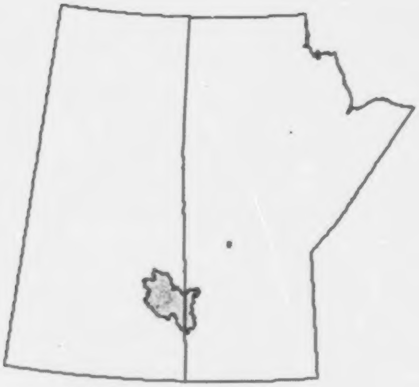
Dichanthelium wilcoxianum
(Sand Millet)



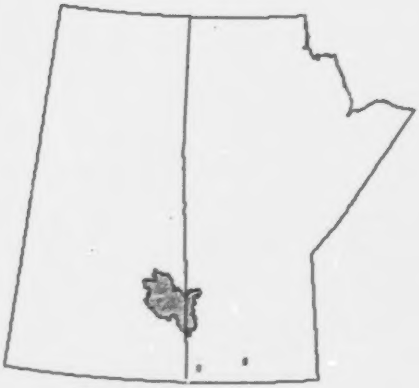
Eleocharis compressa
(Flattened Spike Rush)



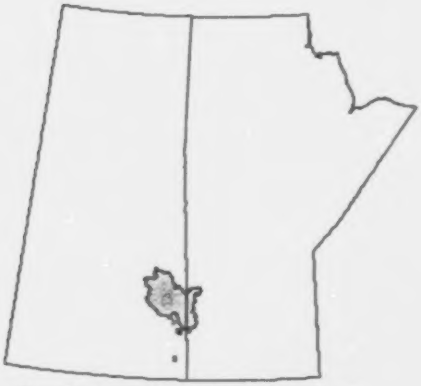
Elymus glaucus
(Smooth Wild Rye)



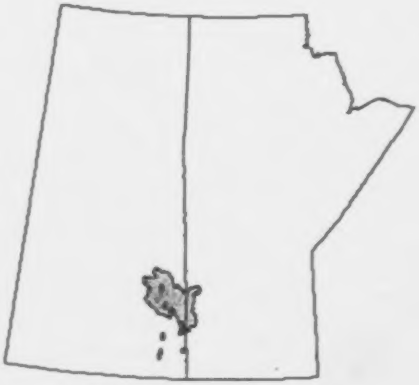
Eriophorum callitrix
(Beautiful Cotton-grass)



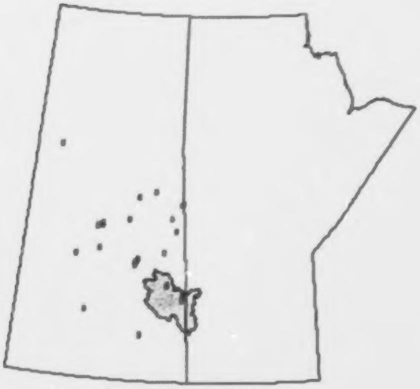
Eurphorbia geyeri
(Prostrate Spurge)



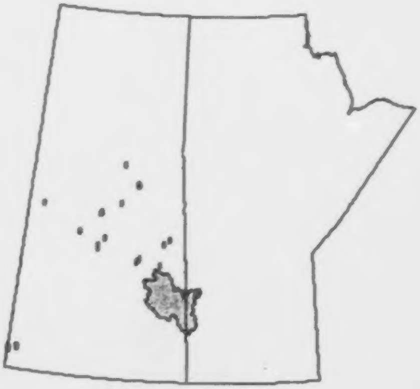
Gentiana andrewsii var. dakotica
(Closed Gentian)



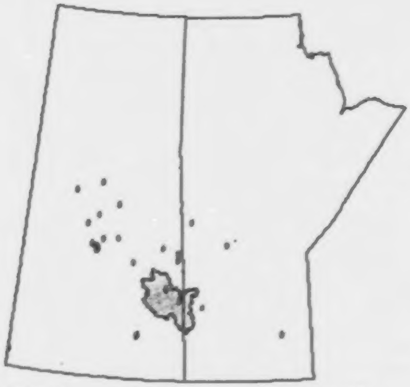
Hypoxis hirsuta
(Yellow Star Grass)



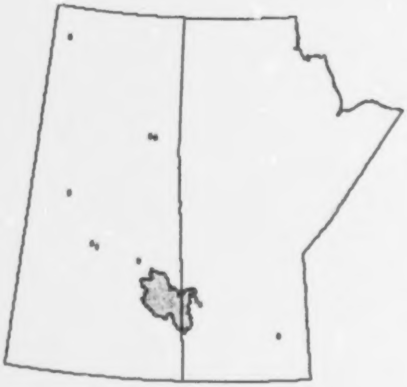
Liparis loeselii
(Twayblade)



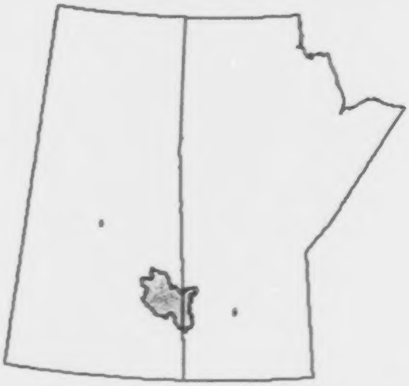
Listera borealis
(Northern Twayblade)



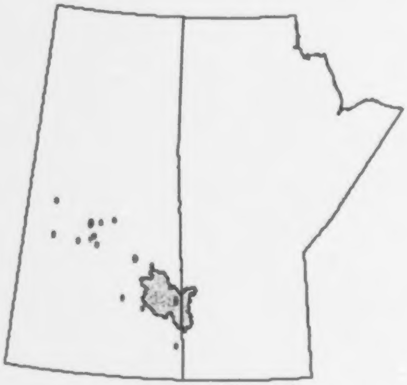
Malaxis monophyllos var. brachypoda
(Adder's Mouth)



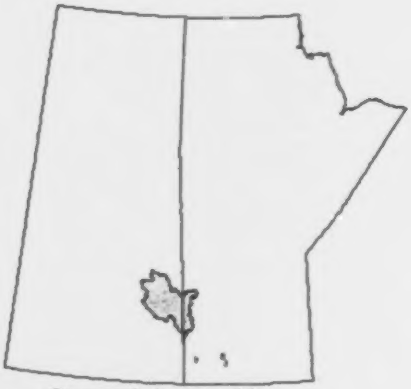
Malaxis paludosa
(Bog Adder's Mouth)



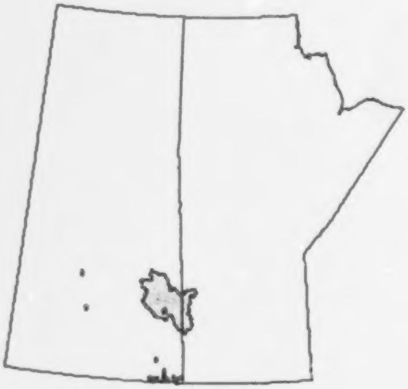
Muhlenbergia andina
(Foxtail Muhly)



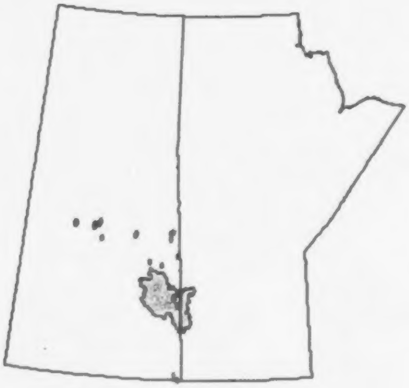
Oryzopsis canadensis
(Canadian Rice Grass)



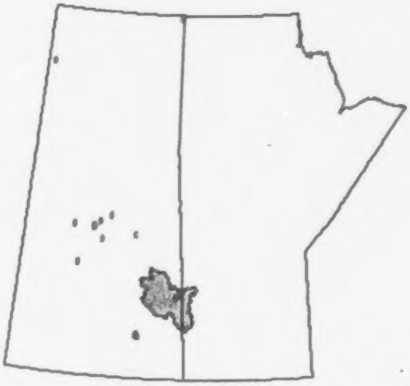
Oryzopsis hymenoides
(Indian Rice Grass)



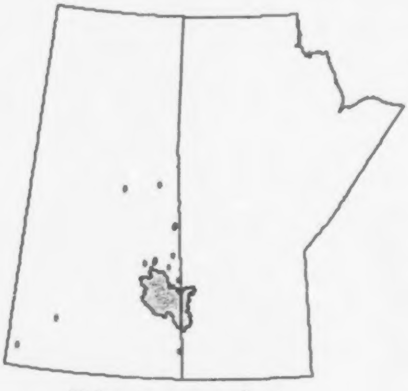
Panicum virgatum
(Switch Grass)



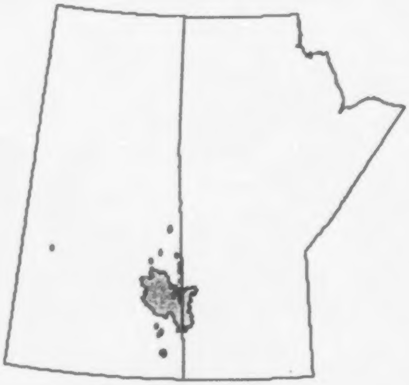
Parnassia glauca
(Glaucous Grass of Parnassus)



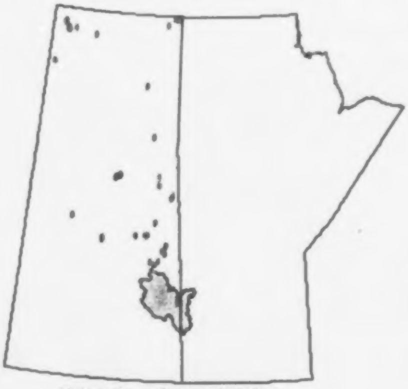
Pinguicula vulgaris
(Butterwort)



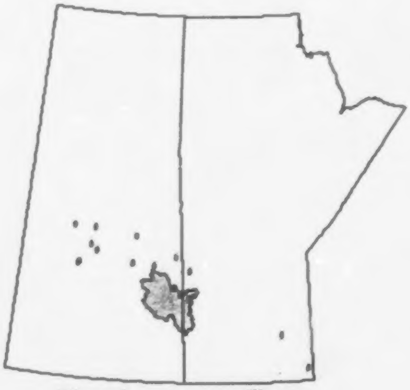
Polygonum scandens
(False Buckwheat)



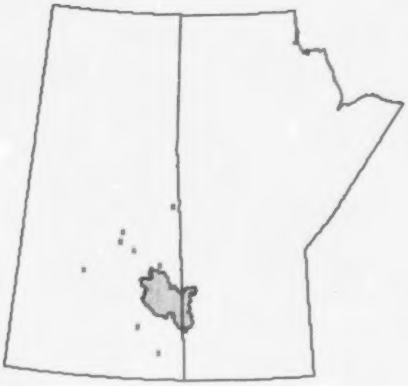
Prenanthes alba
(White Lettuce)



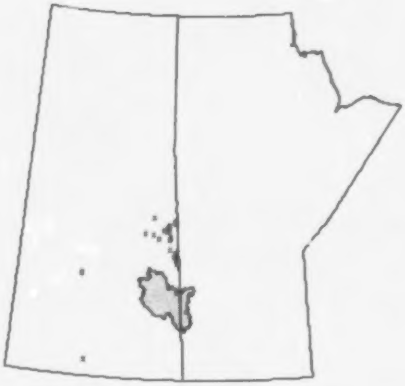
Primula mistassinicia
(Dwarf Primrose)



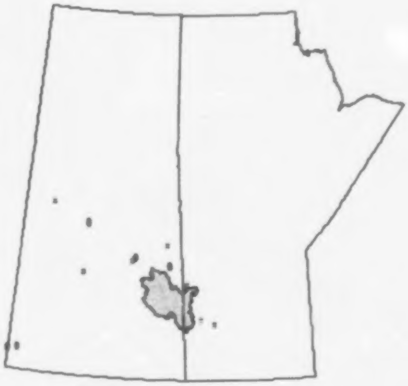
Rhynchospora capillacea
(Slender Beak-rush)



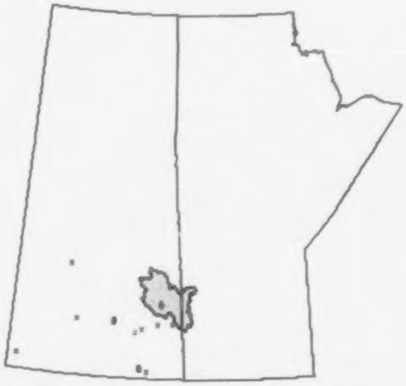
Rosa blanda
(Smooth Rose)



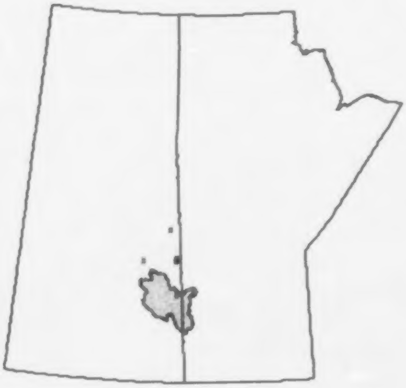
Sambucus racemosa ssp. pubens
(Red Elderberry)



Stipa richardsonii
(Richardson Needle Grass)



Teucrium canadense var. occidenale
(Hairy Germander)



Viola incognita

Appendix 8: Breeding habitat associations for fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT	PERMANENT	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
Birds															
Common Loon									B						1
Pied-billed Grebe		B	B	B	B		B		B						6
Horned Grebe		B	B	B	B				B						5
Red-necked Grebe				B					B						2
Eared Grebe		B	B	B	B										4
Western Grebe							B		B						2
American Bittern	B	B	B	B					B						5
Great Blue Heron							B		B						2
Black-crowned Night Heron		B	B	B			B		B						5
Canada Goose		B	B	B	B	B	B	B	B						8
Wood Duck			B	B		B	B		B						5
Green-winged Teal		B	B	B		B	B		B						6
Mallard	B	B	B	B	B	B	B	B	B						9
Northern Pintail	B	B	B	B	B	B	B	B	B						9
Blue-winged Teal	B	B	B	B	B	B	B	B	B						9
Cinnamon Teal	B	B	B	B	B	B	B	B	B						9
Northern Shovelor	B	B	B	B	B	B	B	B	B						9
Gadwall	B	B	B	B	B	B	B	B	B						9
American Widgeon	B	B	B	B	B	B	B	B	B						9
Canvasback		B	B	B		B	B		B						6
Redhead		B	B	B		B	B		B						6
Ring-necked Duck		B	B	B					B						4
Lesser Scaup		B	B	B		B	B		B						6
White-winged Scoter				B					B						2
Common Goldeneye				B			B		B						3
Bufflehead				B			B		B						3
Common Merganser				B			B		B						3
Hooded Merganser				B			B		B						3
Ruddy Duck		B	B	B					B						4
Turkey Vulture										B					1
Osprey							B		B						2
Bald Eagle							B		B						2
Northern Harrier	B	B	B								B	B			5
Sharp-shinned Hawk										B					1
Cooper's Hawk										B					1
Northern Goshawk										B					1
Broad-winged Hawk										B					1
Swainson's Hawk										B		B			2
Red-tailed Hawk										B					1
American Kestrel										B					1
Merlin										B					1
Gray Partridge												B	B	B	3
Ruffed Grouse										B					1
Sharp-tailed Grouse											B	B			2
Yellow Rail	B	B	B												3
Virginia Rail		B	B	B											3
Sora		B	B	B											3
American Coot		B	B	B					B						4

Appendix 8: Breeding habitat associations for fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT	PERMANENT	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
Sandhill Crane		B	B												2
Piping Plover		B	B				B	B							4
Killdeer	B	B	B	B	B	B	B	B				B		B	10
American Avocet	B	B	B	B	B			B							6
Willet	B	B	B					B				B			5
Spotted Sandpiper				B	B		B	B							4
Solitary Sandpiper							B								1
Upland Sandpiper												B			2
Marbled Godwit	B	B	B	B	B			B				B			7
Common Snipe		B	B	B		B	B		B						6
Wilson's Phalarope	B	B	B												3
Franklin's Gull		B	B	B											3
Bonaparte's Gull									B						1
Ring-billed Gull				B				B							2
California Gull								B							1
Herring Gull								B							1
Common Tern							B	B							2
Forster's Tern			B	B											2
Black Tern		B	B	B					B						4
Rock Dove												B	B	B	3
Mourning Dove										B	B				2
Black-billed Cuckoo										B	B				2
Great-horned Owl										B					1
Barred Owl										B					1
Long-eared Owl										B	B				2
Short-eared Owl	B	B										B			3
Burrowing Owl												B			1
Northern Saw-whet Owl										B					1
Common Nighthawk											B	B			2
Whip-poor-will										B					1
Ruby-throated Hummingbird										B					1
Chimney Swift										B					1
Belted Kingfisher				B			B		B						3
Yellow-bellied Sapsucker										B					1
Downy Woodpecker										B					1
Hairy Woodpecker										B					1
Black-backed Woodpecker										B					1
Three-toed Woodpecker										B					1
Red-headed Woodpecker										B					1
Northern Flicker										B					1
Pileated Woodpecker										B					1
Olive-sided Flycatcher										B					1
Western Wood-Pewee										B					1
Eastern Wood-Pewee										B					1
Great Crested Flycatcher										B					1
Alder Flycatcher									B	B	B				3
Least Flycatcher										B	B				2
Western Kingbird										B	B	B			3
Eastern Kingbird										B	B	B			3

Appendix 8: Breeding habitat associations for fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT	PERMANENT	EXPOSED SHORELINE	VEGETATED SHORELIN	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
Horned Lark												B		B	2
Purple Martin										B					1
Tree Swallow										B					1
Northern Rough-winged Swallow						B	B								2
Bank Swallow					B	B	B								3
Cliff Swallow						B	B								2
Barn Swallow												B	B	B	3
Blue Jay										B					1
Black-billed Magpie										B	B	B			3
American Crow										B	B	B			3
Common Raven										B					1
Black-capped Chickadee										B					1
Boreal Chickadee										B					1
Red-breasted Nuthatch										B					1
White-breasted Nuthatch										B					1
Brown Creeper										B					1
House Wren										B	B				2
Winter Wren										B					1
Sedge Wren	B	B							B						3
Marsh Wren		B	B						B						3
Ruby-crowned Kinglet										B					1
Mountain Bluebird										B					1
Eastern Bluebird										B					1
Swainson's Thrush										B					1
Hermit Thrush										B					1
Veery										B					1
American Robin										B	B				2
Brown Thrasher										B	B				2
Gray Catbird										B	B				2
Sprague's Pipit												B			1
Cedar Waxwing										B	B				2
Loggerhead Shrike											B	B			2
European Starling										B					1
Warbling Vireo										B					1
Red-eyed Vireo										B					1
Philadelphia Vireo										B					1
Blue-headed Vireo										B					1
Orange-crowned Warbler										B	B				2
Tennessee Warbler										B					1
Golden-winged Warbler										B					1
Nashville Warbler										B					1
Yellow Warbler										B	B				2
Chestnut-sided Warbler										B					1
Magnolia Warbler										B					1
Cape May Warbler										B					1
Yellow-rumped Warbler										B					1
Black-throated Green Warbler										B					1
Blackburnian Warbler										B					1
Bay-breasted Warbler										B					1

Appendix 8: Breeding habitat associations for fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT	PERMANENT	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
Blackpoll Warbler										B					1
Black and White Warbler										B					1
Mourning Warbler										B					1
Connecticut Warbler										B					1
American Redstart										B					1
Ovenbird										B					1
Northern Waterthrush						B	B			B	B				4
Common Yellowthroat	B	B	B			B	B		B		B				7
Canada Warbler										B					1
Scarlet Tanager										B					1
Indigo Bunting										B	B				2
Rose-breasted Grosbeak										B					1
Spotted Towhee										B					1
Chipping Sparrow										B					1
Clay-colored Sparrow										B	B	B			3
Vesper Sparrow											B	B	B		3
Lark Sparrow											B				1
Savannah Sparrow	B	B	B									B	B		5
Baird's Sparrow												B			1
Grasshopper Sparrow												B			1
Le Conte's Sparrow	B	B	B									B			4
Nelson's Sharp-tailed Sparrow		B	B												2
Song Sparrow						B	B		B		B				4
Lincoln's Sparrow						B	B		B		B				4
Swamp Sparrow						B	B		B		B				4
White-throated Sparrow										B	B				2
Dark-eyed Junco										B					1
Chestnut-collared Longspur												B			1
Bobolink	B											B	B		3
Red-winged Blackbird	B	B	B	B	B	B	B		B						8
Western Meadowlark												B	B		2
Yellow-headed Blackbird	B	B	B	B					B						5
Brewer's Blackbird											B	B			2
Brown-headed Cowbird									B	B	B	B			4
Baltimore Oriole										B					1
Evening Grosbeak										B					1
Purple Finch										B					1
Pine Siskin										B					1
American Goldfinch										B	B	B			3
White-winged Crossbill										B					1
House Sparrow										B		B	B	B	4
TOTAL	23	43	43	41	17	24	39	18	45	99	33	33	9	6	
Mammals															
Masked Shrew	B	B								B					3
Water Shrew							B								1
Arctic Shrew							B			B					2
Hayden's Shrew												B			1
Montane Shrew	B	B				B	B		B	B					6

Appendix 8: Breeding habitat associations for fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT	PERMANENT	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
Pygmy Shrew	B	B								B		B			4
Short-tailed Shrew	B	B										B			3
Little Brown Myotis						B	B			B					3
Northern Myotis						B	B			B					3
Silver-haired Bat						B	B			B					3
Big Brown Bat			B	B											2
Red Bat										B					1
Hoary Bat										B					1
Snowshoe Hare										B	B				2
White-tailed Jackrabbit											B	B			2
Least Chipmunk						B	B			B					3
Woodchuck						B	B			B					3
Richardson's Ground Squirrel												B	B	B	3
Thirteen-lined Ground Squirrel							B			B	B	B			4
Franklin's Ground Squirrel	B	B								B	B				4
Northern Flying Squirrel										B					1
Northern Pocket Gopher												B	B	B	3
Beaver				B			B		B						3
Deer Mouse	B	B				B	B			B	B	B			7
Northern Grasshopper Mouse												B			1
Heather Vole						B	B					B			3
Gapper's Red-backed Vole						B	B								2
Prairie Vole											B	B			2
Meadow Vole	B	B										B	B		4
Muskrat		B	B	B			B		B						5
Meadow Jumping Mouse	B	B													2
Porcupine										B	B				2
Coyote										B	B	B			3
Gray Wolf										B					1
Red Fox										B	B	B	B	B	5
Black Bear										B					1
Raccoon			B			B	B								3
Ermine						B	B			B	B				4
Least Weasel						B	B			B	B	B			5
Long-tailed Weasel						B	B			B	B	B			5
Mink			B	B		B	B		B						5
Badger												B	B	B	3
Striped Skunk						B	B			B	B	B	B	B	7
Lynx										B					1
Elk						B	B			B					3
White-tailed Deer		B	B	B		B	B			B					6
Moose						B	B			B					3
Total	**8**	**10**	**5**	**5**	**0**	**18**	**23**	**0**	**4**	**29**	**13**	**18**	**6**	**5**	
Reptiles															
Western Painted Turtle		B	B	B		B	B								5
Common Snapping Turtle		B	B	B		B	B								5
Red-sided Garter Snake	B	B	B	B	B	B	B		B	B		B			10
Western Plains Garter Snake	B	B	B	B	B	B	B		B	B		B			10

Appendix 8: Breeding habitat associations for fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT	PERMANENT	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
Total	2	4	4	4	2	4	4	0	2	2	0	2	0	0	
Amphibians															
Boreal Chorus Frog	B	B	B	B	B	B	B	B	B						9
Northern Leopard Frog	B	B	B	B	B	B	B	B	B						9
Wood Frog	B	B	B												3
Canadian Toad	B	B	B	B	B	B	B	B	B						9
Tiger Salamander	B	B	B	B	B	B	B	B	B						9
TOTAL	4	4	4	3	3	3	3	3	3	0	0	0	0	0	

Appendix 9: Habitat assocations for foraging fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT RIPARIAN	PERMANENT RIPARIAN	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
Birds															
Common Loon				F											1
Pacific Loon				F											1
Pied-billed Grebe	F	F	F	F	F		F	F	F						8
Horned Grebe	F	F	F	F	F		F	F	F						8
Red-necked Grebe			F	F	F		F	F	F						6
Eared Grebe	F	F	F	F	F		F	F	F						8
Western Grebe		F	F	F	F		F	F	F						7
American White Pelican			F	F	F	F	F	F	F						7
Double-crested Cormorant			F	F	F	F	F	F	F						7
American Bittern	F	F	F	F					F						5
Great Blue Heron	F	F	F	F	F	F	F	F	F						9
Black-crowned Night Heron	F	F	F	F		F	F	F	F						8
Tundra Swan	F	F	F	F											4
Greater White-fronted Goose	F	F	F	F									F	F	6
Snow Goose	F	F	F	F									F	F	6
Ross Goose	F	F	F	F									F	F	6
Canada Goose	F	F	F	F	F	F	F	F	F				F	F	11
Wood Duck	F	F	F	F	F	F	F	F	F						9
Green-winged Teal	F	F	F	F	F	F	F	F	F						9
Mallard	F	F	F	F	F	F	F	F	F						9
Northern Pintail	F	F	F	F	F	F	F	F	F						9
Blue-winged Teal	F	F	F	F	F	F	F	F	F						9
Cinnamon Teal	F	F	F	F	F	F	F	F	F						9
Northern Shovelor	F	F	F	F	F	F	F	F	F						9
Gadwall	F	F	F	F	F	F	F	F	F						9
American Widgeon	F	F	F	F	F	F	F	F	F						9
Canvasback	F	F	F	F	F	F	F	F	F						9
Redhead	F	F	F	F	F	F	F	F	F						9
Ring-necked Duck	F	F	F	F	F	F	F	F	F						9
Lesser Scaup	F	F	F	F	F	F	F	F	F						9
Greater Scaup				F											1
Surf Scoter				F											1
White-winged Scoter		F	F	F	F		F	F	F						7
Common Goldeneye		F	F	F	F	F	F	F	F						8
Bufflehead		F	F	F	F	F	F	F	F						8
Common Merganser				F	F	F	F	F	F						6
Hooded Merganser				F	F	F	F	F	F						6
Ruddy Duck	F	F	F	F	F		F	F	F						8
Turkey Vulture										F	F				2
Osprey			F	F			F	F	F						5
Bald Eagle			F	F			F	F	F	F	F	F			8
Northern Harrier	F	F	F	F	F	F	F	F	F		F	F	F	F	13
Sharp-shinned Hawk										F	F				2
Cooper's Hawk										F	F				2
Northern Goshawk										F					1
Broad-winged Hawk										F					1
Swainson's Hawk												F	F	F	3

Appendix 9: Habitat assocations for foraging fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT RIPARIAN	PERMANENT RIPARIAN	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
Red-tailed Hawk										F	F	F	F	F	5
Rough-legged Hawk												F	F	F	3
American Kestrel										F	F	F	F	F	5
Merlin										F	F	F	F	F	5
Gyrfalcon												F	F	F	3
Prairie Falcon	F	F	F	F	F							F	F	F	8
Peregrine Falcon	F	F	F	F	F							F	F	F	8
Gray Partridge												F	F	F	3
Ruffed Grouse										F	F				2
Sharp-tailed Grouse										F	F	F	F	F	5
Yellow Rail	F	F	F												3
Virginia Rail	F	F	F	F											4
Sora	F	F	F	F											4
American Coot	F	F	F	F	F	F	F	F	F						9
Sandhill Crane	F	F	F	F								F	F	F	7
Whooping Crane	F	F	F	F								F	F	F	7
Piping Plover	F	F						F							3
Semipalmated Plover	F	F	F					F							4
American Golden Plover	F	F	F					F					F	F	6
Black-bellied Plover	F	F	F					F					F	F	6
Killdeer	F	F	F	F	F	F	F	F				F		F	10
American Avocet	F	F	F	F	F		F	F							7
Willet	F	F	F	F	F		F	F				F			8
Spotted Sandpiper	F	F	F	F	F	F	F	F							8
Solitary Sandpiper	F	F	F	F	F	F	F	F							8
Upland Sandpiper												F	F		2
Ruddy Turnstone							F	F							2
Whimbrel	F	F	F					F							4
Greater Yellowlegs	F	F	F					F							4
Lesser Yellowlegs	F	F	F					F							4
Red Knot	F	F	F					F							4
Pectoral Sandpiper	F	F	F					F							4
White-rumped Sandpiper	F	F	F					F							4
Baird's Sandpiper	F	F	F					F							4
Least Sandpiper	F	F	F					F							4
Short-billed Dowitcher	F	F	F					F							4
Long-billed Dowitcher	F	F	F					F							4
Stilt Sandpiper	F	F	F					F							4
Semipalmated Sandpiper	F	F	F					F							4
Buff-breasted Sandpiper	F	F	F					F						F	5
Hudsonian Godwit	F	F	F					F							4
Sanderling	F	F	F					F							4
Marbled Godwit	F	F	F	F	F	F	F	F				F	F	F	11
Common Snipe	F	F	F	F		F	F		F						7
Red-necked Phalarope	F	F	F	F											4
Wilson's Phalarope	F	F	F	F	F			F							6
Franklin's Gull	F	F	F	F	F		F	F	F					F	10
Bonaparte's Gull		F	F	F			F	F	F						6

Appendix 9: Habitat assocations for foraging fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT RIPARIAN	PERMANENT RIPARIAN	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
Ring-billed Gull	F	F	F	F	F	F	F	F	F					F	10
California Gull	F	F	F	F	F	F	F	F	F					F	10
Herring Gull	F	F	F	F	F	F	F	F	F						9
Caspian Tern					F		F								2
Common Tern		F	F	F	F	F	F	F	F						8
Forster's Tern		F	F	F	F	F	F	F	F						8
Black Tern	F	F	F	F	F			F	F						7
Rock Dove													F	F	2
Mourning Dove										F	F	F			3
Black-billed Cuckoo										F	F				2
Snowy Owl												F	F	F	3
Great-horned Owl										F	F	F	F	F	5
Barred Owl										F					1
Long-eared Owl										F	F				2
Short-eared Owl	F	F	F	F		F	F	F	F			F	F	F	11
Burrowing Owl												F	F	F	3
Boreal Owl										F					1
Northern Saw-whet Owl										F					1
Common Nighthawk												F			1
Whip-poor-will										F					1
Ruby-throated Hummingbird										F					1
Chimney Swift										F					1
Belted Kingfisher				F	F	F	F	F	F						7
Yellow-bellied Sapsucker										F					1
Downy Woodpecker										F					1
Hairy Woodpecker										F					1
Black-backed Woodpecker										F					1
Three-toed Woodpecker										F					1
Red-headed Woodpecker										F					1
Northern Flicker										F					1
Pileated Woodpecker									F	F					2
Olive-sided Flycatcher										F					1
Western Wood-Pewee										F					1
Eastern Wood-Pewee										F					1
Great Crested Flycatcher										F					1
Yellow-bellied Flycatcher										F					1
Alder Flycatcher									F	F	F				3
Least Flycatcher										F	F				2
Western Kingbird										F	F	F	F	F	5
Eastern Kingbird										F	F	F	F	F	5
Horned Lark												F	F	F	3
Tree Swallow		F	F	F	F	F	F	F	F	F		F	F	F	12
Northern Rough-winged Swallow						F	F	F	F						4
Bank Swallow		F	F	F	F	F	F	F	F						8
Cliff Swallow		F	F	F		F	F	F	F						7
Barn Swallow		F	F	F	F	F	F	F	F			F	F	F	11
Blue Jay										F					1
Black-billed Magpie										F	F	F	F	F	5

Appendix 9: Habitat assocations for foraging fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT RIPARIAN	PERMANENT RIPARIAN	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
American Crow	F	F	F	F	F	F	F	F	F	F	F	F	F	F	14
Common Raven										F					1
Black-capped Chickadee										F					1
Boreal Chickadee										F					1
Red-breasted Nuthatch										F					1
White-breasted Nuthatch										F					1
Brown Creeper										F					1
House Wren										F	F				2
Winter Wren										F					1
Sedge Wren	F	F							F						3
Marsh Wren		F	F						F						3
Mountain Bluebird										F					1
Eastern Bluebird										F					1
Swainson's Thrush										F					1
Hermit Thrush										F					1
Gray-cheeked Thrush										F					1
Veery										F	F				2
American Robin										F	F				2
Gray Catbird										F	F				2
Brown Thrasher										F	F				2
Ruby-crowned Kinglet										F					1
Golden-crowned Kinglet										F					1
Sprague's Pipit												F	F	F	3
American Pipit	F	F	F	F				F				F	F	F	8
Cedar Waxwing										F	F				2
Bohemian Waxwing										F	F				2
Loggerhead Shrike											F	F	F	F	4
Northern Shrike											F	F	F	F	4
European Starling										F		F	F	F	4
Warbling Vireo										F					1
Red-eyed Vireo										F					1
Blue-headed Vireo										F					1
Philadelphia Vireo										F					1
Tennessee Warbler										F					1
Orange-crowned Warbler										F	F				2
Golden-winged Warbler										F					1
Nashville Warbler										F					1
Yellow Warbler										F	F				2
Chestnut-sided Warbler										F					1
Magnolia Warbler										F					1
Cape May Warbler										F					1
Yellow-rumped Warbler										F					1
Black-throated Green Warbler										F					1
Blackburnian Warbler										F					1
Palm Warbler										F					1
Bay-breasted Warbler										F					1
Blackpoll Warbler										F					1
Black and White Warbler										F					1

Appendix 9: Habitat assocations for foraging fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT RIPARIAN	PERMANENT RIPARIAN	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
American Redstart										F					1
Ovenbird										F					1
Northern Waterthrush						F	F			F	F				4
Mourning Warbler										F					1
Connecticut Warbler										F					1
Common Yellowthroat	F	F	F			F	F		F	F	F				8
Canada Warbler										F					1
Wilson's Warbler										F					1
Scarlet Tanager										F					1
Indigo Bunting										F	F				2
Rose-breasted Grosbeak										F					1
Spotted Towhee										F					1
Chipping Sparrow										F					1
Clay-colored Sparrow										F	F	F	F	F	5
American Tree Sparrow										F	F	F	F	F	5
Vesper Sparrow											F	F	F	F	4
LarkSparrow											F	F			2
Savannah Sparrow	F	F	F									F	F	F	6
Baird's Sparrow												F	F	F	3
Grasshopper Sparrow												F			1
Le Conte's Sparrow	F	F	F									F			4
Nelson's Sharp-tailed Sparrow		F	F												2
Fox Sparrow										F					1
Song Sparrow						F	F		F		F				4
Lincoln's Sparrow						F	F		F		F				4
Swamp Sparrow						F	F		F		F				4
White-throated Sparrow										F	F				2
White-crowned Sparrow										F					1
Harris Sparrow										F					1
Dark-eyed Junco										F					1
Chestnut-collared Longspur												F	F	F	3
Lapland Longspur	F	F	F	F	F							F	F	F	8
Snow Bunting												F	F	F	3
Bobolink	F	F	F									F	F	F	6
Red-winged Blackbird	F	F	F	F	F	F	F	F	F						9
Western Meadowlark												F	F	F	3
Yellow-headed Blackbird	F	F	F	F					F						5
Brewer's Blackbird											F	F			2
Rusty Blackbird	F	F	F	F	F	F	F	F	F						9
Brown-headed Cowbird									F	F	F	F			4
Baltimore Oriole										F					1
Evening Grosbeak										F					1
Pine Grosbeak										F					1
Purple Finch										F					1
Hoary Redpoll										F	F	F	F	F	5
Common Redpoll										F	F	F	F	F	5
Pine Siskin										F					1
American Goldfinch										F	F	F			3

Appendix 9: Habitat assocations for foraging fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT RIPARIAN	PERMANENT RIPARIAN	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
Red Crossbill										F					1
White-winged Crossbill										F					1
House Sparrow										F		F	F	F	4
TOTAL	**79**	**92**	**95**	**77**	**55**	**49**	**64**	**79**	**63**	**116**	**47**	**55**	**52**	**55**	
Mammals															
Masked Shrew	F	F								F		F			4
Water Shrew							F								1
Arctic Shrew							F			F					2
Hayden's Shrew												F			1
Montane Shrew	F	F				F	F		F	F					6
Pygmy Shrew	F	F								F		F			4
Short-tailed Shrew	F	F										F			3
Little Brown Myotis	F	F	F	F		F	F	F	F	F					9
Northern Myotis	F	F	F	F		F	F	F	F	F					9
Silver-haired Bat	F	F	F	F		F	F	F	F	F					9
Big Brown Bat	F	F	F	F		F	F	F	F						8
Red Bat	F	F	F	F		F	F	F	F	F					9
Hoary Bat	F	F	F	F		F	F	F	F	F					9
Snowshoe Hare										F	F				2
White-tailed Jackrabbit											F	F			2
Least Chipmunk						F	F			F					3
Woodchuck						F	F			F					3
Richardson's Ground Squirrel												F			1
Thirteen-lined Ground Squirrel							F			F	F	F			4
Franklin's Ground Squirrel	F	F								F	F	F			5
Northern Flying Squirrel										F					1
Northern Pocket Gopher												F			1
Beaver				F		F	F		F	F					5
Deer Mouse	F	F				F	F			F	F	F			7
Northern Grasshopper Mouse												F			1
Heather Vole						F	F								2
Gapper's Red-backed Vole						F	F								2
Meadow Vole	F	F										F			3
Muskrat		F	F	F	F	F	F	F	F						8
Prairie Vole											F	F			2
Norway Rat												F	F	F	3
House Mouse											F	F	F	F	4
Meadow Jumping Mouse	F	F										F			3
Porcupine										F	F				2
Coyote	F	F	F			F	F			F	F	F	F	F	10
Gray Wolf										F					1
Red Fox	F	F	F	F	F	F	F			F	F	F	F	F	12
Black Bear						F	F			F					3
Raccoon	F	F	F	F	F	F	F	F	F	F	F	F	F	F	14
Ermine	F	F				F	F			F	F				6
Least Weasel	F	F				F	F			F	F	F	F	F	9
Long-tailed Weasel	F	F				F	F			F	F	F	F	F	9

Appendix 9: Habitat assocations for foraging fauna in the Upper Assiniboine River Basin

	WETLANDS									UPLANDS					
SPECIES	TEMPORARY	SEASONAL	SEMI-PERMANENT	PERMANENT	ARTIFICIAL	INTERMITTENT RIPARIAN	PERMANENT RIPARIAN	EXPOSED SHORELINE	VEGETATED SHORELINE	WOODED	SHRUB	NATIVE GRASSLANDS	TAME FORAGE	CROPLANDS	TOTAL
Mink	F	F	F	F	F	F	F	F	F						9
Badger												F	F	F	3
Striped Skunk	F	F	F	F	F	F	F	F	F	F	F	F	F	F	14
Lynx										F					1
Elk						F	F			F					3
White-tailed Deer	F	F	F	F		F	F			F	F	F	F	F	11
Moose				F		F	F			F	F				5
TOTAL	**23**	**24**	**13**	**14**	**5**	**26**	**29**	**10**	**12**	**31**	**17**	**24**	**10**	**10**	
Reptiles															
Western Painted Turtle	F	F	F	F		F	F								6
Common Snapping Turtle	F	F	F	F		F	F								6
Red-sided Garter Snake	F	F	F	F	F	F	F		F	F	F	F			11
Western Plains Garter Snake	F	F	F	F	F	F	F		F	F	F	F			11
TOTAL	**4**	**4**	**4**	**4**	**2**	**4**	**4**	**0**	**2**	**2**	**2**	**2**	**0**	**0**	
Amphibians															
Boreal Chorus Frog	F	F	F	F	F	F	F	F	F						9
Northern Leopard Frog	F	F	F	F	F	F	F	F	F						9
Wood Frog	F	F	F	F	F	F	F	F	F	F	F				11
Canadian Toad	F	F	F	F	F	F	F	F	F	F	F	F			12
Tiger Salamander	F	F	F	F	F	F	F	F	F			F			10
TOTAL	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**2**	**2**	**1**	**0**	**0**	

Appendix II

Habitat Trends in the Upper Assiniboine River Basin: Canadian Wildlife Service Habitat Monitoring

Habitat Trends in the Upper Assiniboine River Basin: Canadian Wildlife Service Habitat Monitoring

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Canadian Wildlife Service
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Introduction

The Canadian Wildlife Service (CWS) and the United States Geological Survey (USGS) have co-operatively designed and delivered aerial surveys in prairie Canada since the 1950s. These surveys are conducted annually in May throughout the agricultural areas of Alberta, Manitoba and Saskatchewan, and they were designed to provide indices to the numbers of breeding prairie waterfowl. These surveys, and Christmas bird counts, are the most comprehensive biological surveys (in terms of geographic scope and number of years) in North America. Although the Upper Assiniboine River Basin (UARB) is a very small portion of this survey region, survey data within the basin provides unique long-term information regarding waterfowl species composition, and waterfowl and wetland abundance.

In the late 1970s CWS initiated a habitat monitoring program as part of ground surveys which were used to provide visibility correction factors for aerial counts of waterfowl. The ground habitat assessments provided additional information on wetland type and wetland conditions as they are affected by a variety of agricultural activities. By 1981 this habitat monitoring program was operational throughout prairie Canada, and in 1991 and 1992 additional ground survey transects were added as part of the North American Waterfowl Management Program (NAWMP). These habitat assessments provide a unique and yearly assessment of habitat quality of prairie wetlands and their adjacent upland habitat.

These waterfowl and habitat survey data provide an opportunity to address several important questions in assessing the impacts of past, current and future agricultural activities upon wetlands within the UARB, and to contribute to the development of effective habitat management programs within the basin:

- Have wetland numbers decreased over time in the UARB?
- What types of wetlands are there, and do wetlands change in character over the short-term?
- Have some types of wetlands been more subject to changes in numbers?
- What types of agricultural impacts are associated with wetlands? Do different wetland types vary in the degree of these impacts?
- Have these agricultural impacts varied over time, and do they differ depending upon location within the UARB?
- What are the trends in occurrence of various upland cover types within the UARB?

Methods

Aerial Surveys

Aerial surveys were initiated in the 1950s to 1960s throughout prairie Canada to provide an index to the number of waterfowl in the May breeding period. Surveys were conducted along east-west transects with each transect composed on a variable number of contiguous 18-mile long segments. The number of each species of waterfowl were recorded within a 1/8-mile strip on either side of the aircraft. The number of ponds within the pilot's side of the aircraft was also recorded (excluding shallow water or temporary wetlands). Surveys were conducted in the month of May each year.

Although the coverage of this survey is comprehensive in geographic scope, the relatively low sampling intensity and high spatial variability of waterfowl populations result in this survey data being best used as an index to populations rather than absolute estimates. This design and type of survey data were, and are, appropriate for monitoring trends of waterfowl species for use in harvest regulation. Within the UARB there are 10 of these survey segments associated with portions of 6 of the transects.

Ground Surveys

Selected segments along the aerial survey transects were used for ground surveys to develop visibility correction factors for the aerial observations (i.e. assume ground crews record "all" ponds and waterfowl). By 1981 an operational habitat assessment for these ground survey segments was in place to provide detailed evaluation of wetland conditions and agricultural impacts. In 1991 and 1992, in response to needs of the NAWMP, more ground survey segments were added. Ground surveys were conducted soon after the aerial surveys each year. Within the UARB there are two ground survey segments with information from 1981, one from 1982, one from 1991 and one from 1992.

Wetland Types: The aerial survey data simply counted all wetlands except for those of temporary nature. The ground surveys provided a more detailed assignment of wetland type, based on water permanence, for every wetland basin regardless if it contained any surface water at the time of survey. The following wetland types were assigned assuming a spring and early summer of average precipitation and temperature:

dry basin	no surface water in basin
temporary	maximum water depth of 15 cm; dry by end of May
seasonal	maximum water depth > 15 cm to 1 m or more; surface water maintained to mid-July
semi-permanent	maximum water depth > 1 m; in most years surface water maintained to freeze-up
permanent	maximum water depth > 1 m; dry only after periods of extreme and prolonged drought.
stream segment	portion of stream channel in segment with some surface water
dry stream	no surface water in stream bed
artificial wetland	dugout, gravel pit, borrow pit, stock pond, reservoir, sewage lagoon, irrigation canal

The wetland classification uses the current year's water conditions for each basin inspected. This was highly variable among years, due to variable spring run-off water from snow melt, and the wetland type of a given basin could, and did, vary among years. To allow an assessment of wetland conditions and agriculture impacts a 'base type' was assigned to each basin from a review of the basin's annual classifications. This base type represented the most permanent water condition possible for each basin based on its survey history.

Wetland Basin: The basin of a wetland was defined as the lowest area of the wetland up to the full supply level. This included the area to the outer edge of the wet meadow vegetation zone (based on plant species composition), and this limit was often evident by the presence of a border of moist site shrubs (willows). A variable portion of the area of the basin would be covered by water depending upon the spring water conditions.

Wetland Margin: The margin of a wetland was defined as the upland habitat, composed of natural vegetation, for the first 10 m beyond the outer limit of the basin. This 10-m width was selected as a margin "width" since intact margins were usually much less in width (due to cultivation) and this distance from the wetland basin was important from a biological view (high species diversity, important nesting habitat for waterfowl). The average width of the margin around the entire basin was visually estimated from 0 to 10 m. If the wetland basin was surrounded by extensive vegetation beyond this 10-m distance, the margin was still recorded to be 10 m wide. The margin width of 10 represented a value at least 10 m.

Woody Vegetation: The proportion of the area of the basin which was covered by woody vegetation (trees or shrubs, usually the latter) was estimated visually. The proportion of the perimeter of the margin which contained woody vegetation was also estimated visually. The width of this margin, and whether is was composed of trees or shrubs, was not evaluated.

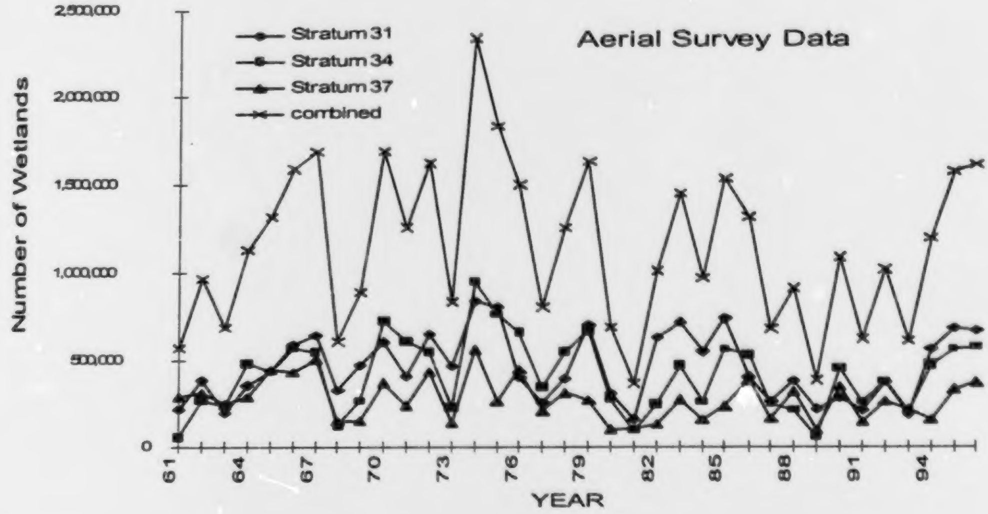
Agricultural Impacts: Agricultural impacts upon wetland basins and their margins were assessed by visual estimates of the area of basin, and the area of any margin which had not been cultivated:

Cultivation	breaking of native vegetation of basins and margins and seeding and maintenance of crops; cultivation of basins was considered to be a transitory impact due to variable water conditions; cultivation of margins was considered to be a permanent impact since recovery of native vegetation was unlikely once cropping was established; the estimated margin width (0 - 10 m) represented the proportion of the margin width which was not cultivated (0% to 100%)
draining	evidence of drainage (e.g. ditching) which affected capability of basin to retain surface water; in many cases shallow fall ditching of more temporary wetlands in cropland was not detectable as was sub-surface drainage; drainage could be variable in its effect
clearing	evidence of clearing of woody vegetation of basins or margins, in the form of piles of cleared material; although woody vegetation can recover, it most cases it was considered to be a permanent impact for both basins and margins once cultivation ensued
filling	placement of materials within the basin or along the margin; most often stone piles, occasionally refuse, and temporarily from the clearing of woody vegetation and prior to its burning
haying	evidence of haying of basin or margin (mowing, swaths or bale) in previous year; transitory impact upon basins and wetlands
grazing	evidence of use by livestock (presence of livestock, tracks, grazed vegetation, feces); transitory impact upon basins and wetlands
burning	evidence of burning in fall (weathered ashes) or current spring (less weathered ashes); transitory impact upon basins and margins
farmyard	portion of basin or margin within active farmyard; habitat may be intact but disturbance may affect use by breeding waterfowl and other wildlife; considered to be a permanent impact
right-of-way	portion of wetland adjacent to right-of-way of road; considered to be a permanent impact

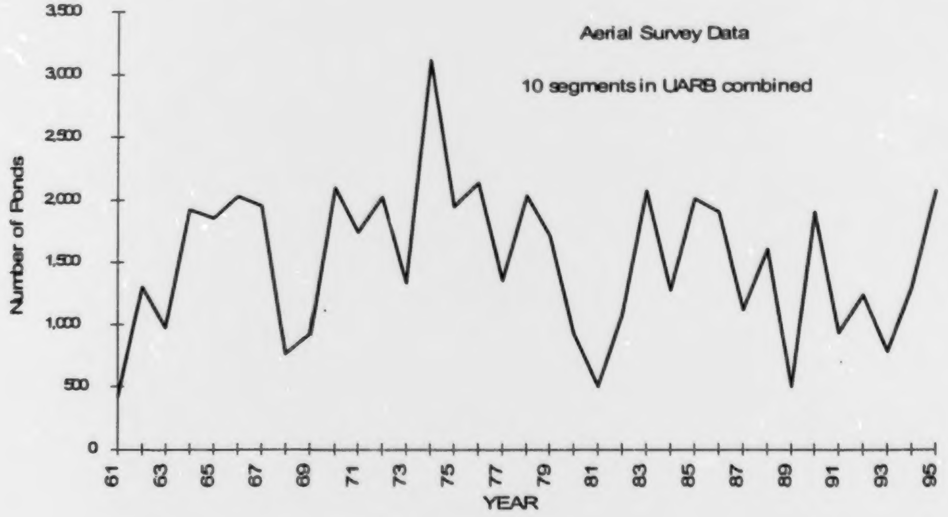
Upland Habitat: Proportion of upland habitat away from wetlands and their margins was assessed by estimating the proportion of each upland habitat abutting the perimeter of each margin: crop, summerfallow, stubble, hayland, native pasture, native woody pasture, woody vegetation (trees or shrubs), and native grassland. The cumulative proportion along these wetland margins was an effective surrogate measure of actual area (D. Tide, 1999, unpubl. MSc. thesis).

Number of Wetlands

The UARB is located within the eastern portions of aerial survey strata 31 and 34 in Saskatchewan, and the western portion of stratum 37 in Manitoba. Counts of wetlands within strata are highly variable among years, reflecting the high annual variation in water supply from spring run-off following snow melt. The years of 1987 to 1993 represented a period of relatively low numbers of wetlands, with increasing numbers thereafter.

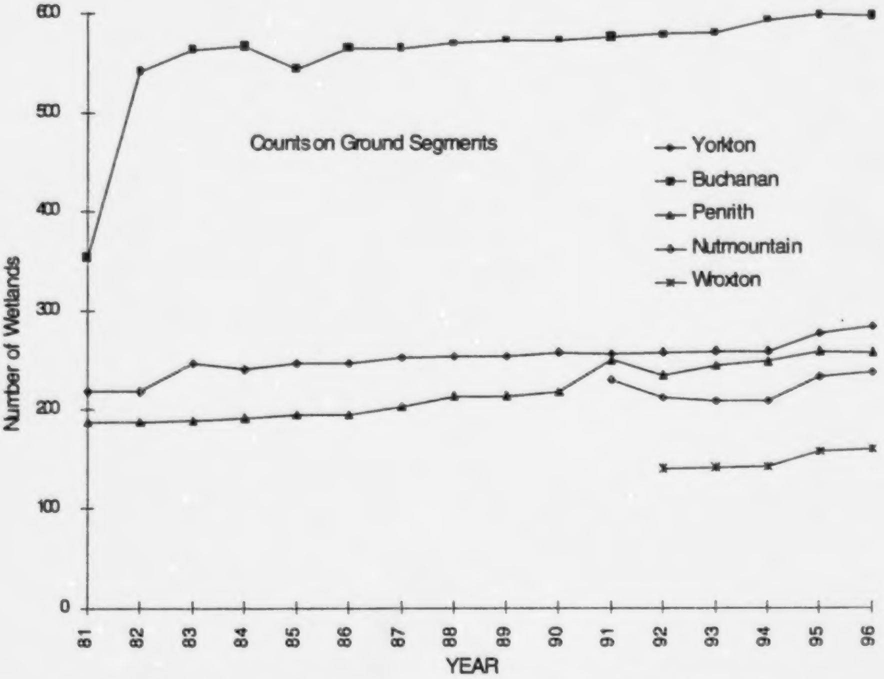


There was a similar variation in number of wetlands for those 10 aerial survey segments within the UARB. The number of wetlands varied from 500 to over 3000 between 1961 and 1995. Wetlands were relatively low in number in the UARB beween 1987 and 1993, during a period of relatively low numbers throughout prairie Canada. Numbers of wetlands have been increasing thereafter.



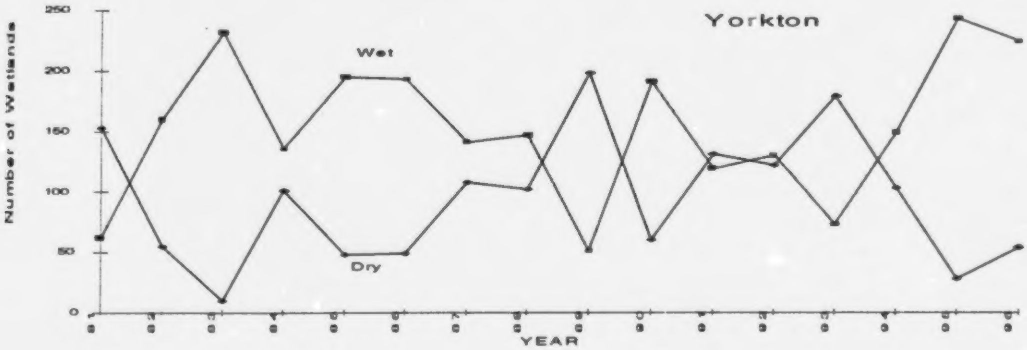
Although the aerial surveys provide an index to abundance of wetlands, and illustrate the considerable variation in numbers of wetlands, the data do not indicate any dramatic decline in wetland numbers over the survey period. It must be noted these surveys record the number of wetland basins with surface water but do not include the temporary wetlands, or basins which remain but are dry.

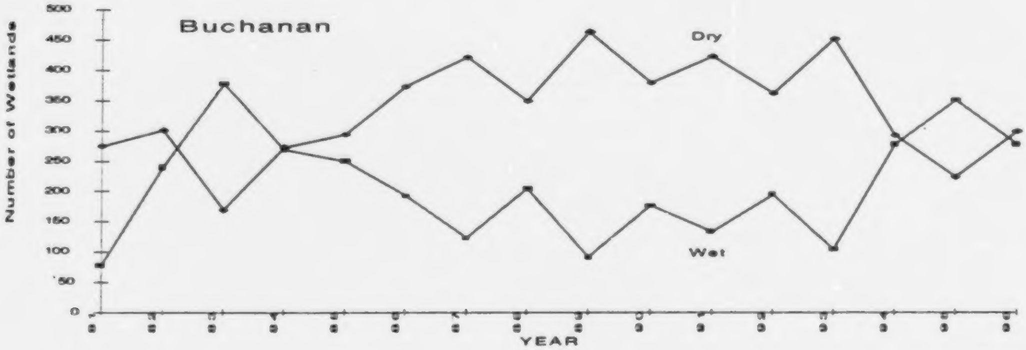
Counts of wetlands on ground survey segments do include temporary wetlands, and those basins which are dry. However, this data base is somewhat dynamic in that new wetlands are added to the data bases over the survey period. During more dry conditions some basins have been subdivided into two or more basins when drawdown of water levels exposes formerly inundated ground between deeper portions of larger basins. In some cases new wetlands, usually temporary, were not detected during the initial aerial photo-interpretation but these became apparent in years of high spring run-off. Occasionally artificial wetlands, usually dugouts, were added when they were created. The addition of wetlands to data bases, particularly temporary wetlands which may be more vulnerable to loss, masks any losses of wetlands on these ground transects. Wetland numbers appear to gradually increase for all five ground survey segments for these reasons.

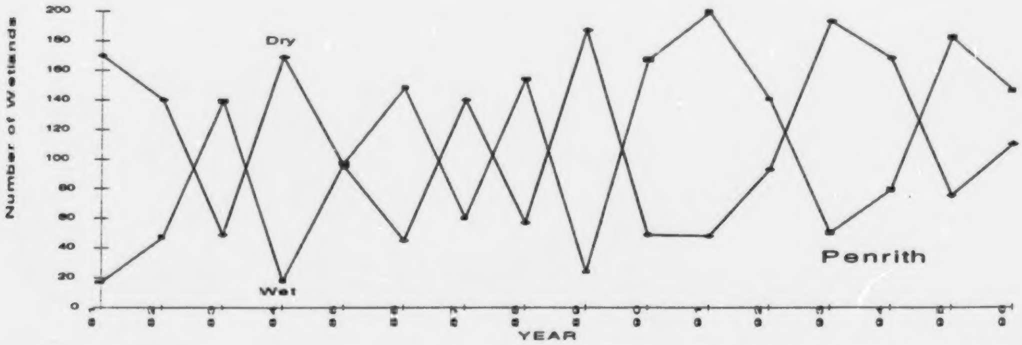


The CWS habitat monitoring data base is not designed to detect the gradual loss of small numbers of wetlands, but rather to assess the changes in wetland conditions (in term of wetland type) and the effects of agricultural practices upon basins and margins. Focusing on those wetlands present in 1981 only is not adequate to assess change in numbers since all basins are maintained within the data base even if they rarely, or never, hold surface water in May. These wetlands do provide habitat for arriving waterfowl even though many do not have surface water by early May.

The variation among years in numbers of wetlands containing surface water and those dry at the time of survey in early May can be considerable. This variation is also expressed among the different areas despite their relative proximity. At Yorkton wetlands with surface water more abundant in the early 1980s, dry ponds became more frequent with increasing drought in the late 1980s, and wetland with surface water again increased in numbers thereafter as water conditions improved. At Buchanan dry ponds were most abundant except during the the early 1980s and late 1990s when water conditions improved. At Penrith, which is characterized by a large number of temporary wetlands, the proportion of wetlands with or without surface water fluctuated greatly. Differences in spring run-off among areas can greatly affect the proportion of wetlands which retain surface water in early May, and the type of wetlands present are in turn important.







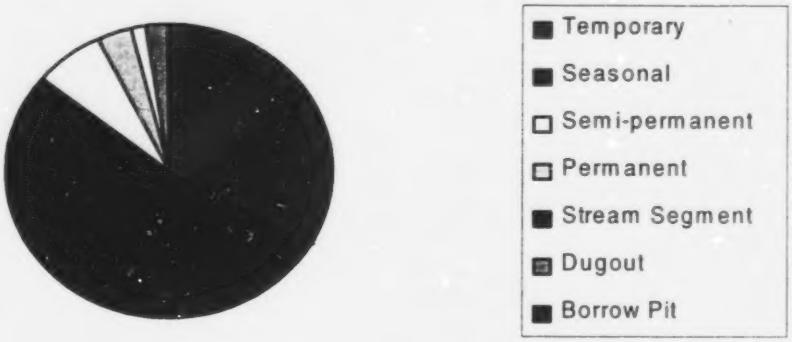
Wetland Type

There is considerable variation in proportion of the wetland basetypes among the five ground survey segments within the UARB. The basetype is that with the greatest water permanency expected for a given basin based on its type history over the period of the survey.

Numbers of wetland basetypes of five transects within the Upper Assiniboine River Basin

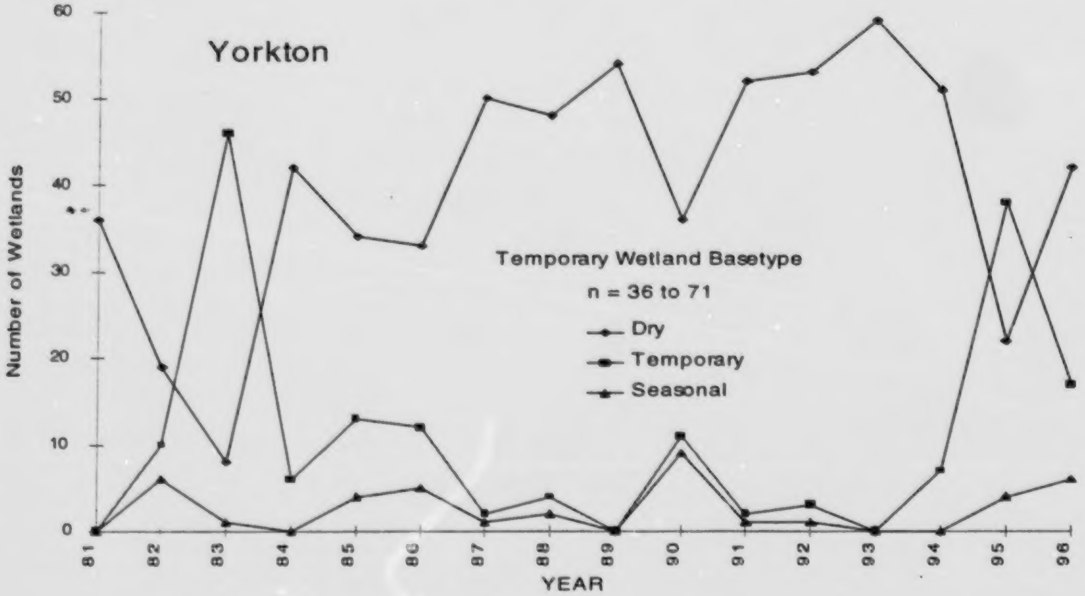
Wetland Basetype	Yorkton	Buchanan	Nut Mountain	Wroxton	Penrith	Combined
Temporary	71	144	93	79	121	508
Seasonal	132	364	138	69	107	810
Semi-permanent	38	46	0	5	18	107
Permanent	35	15	0	0	1	51
Stream Segment	3	8	2	2	7	22
Dugout	3	22	4	2	3	34
Borrow Pit	1	2	0	2	0	5
Total Wetlands	283	601	237	159	257	1537

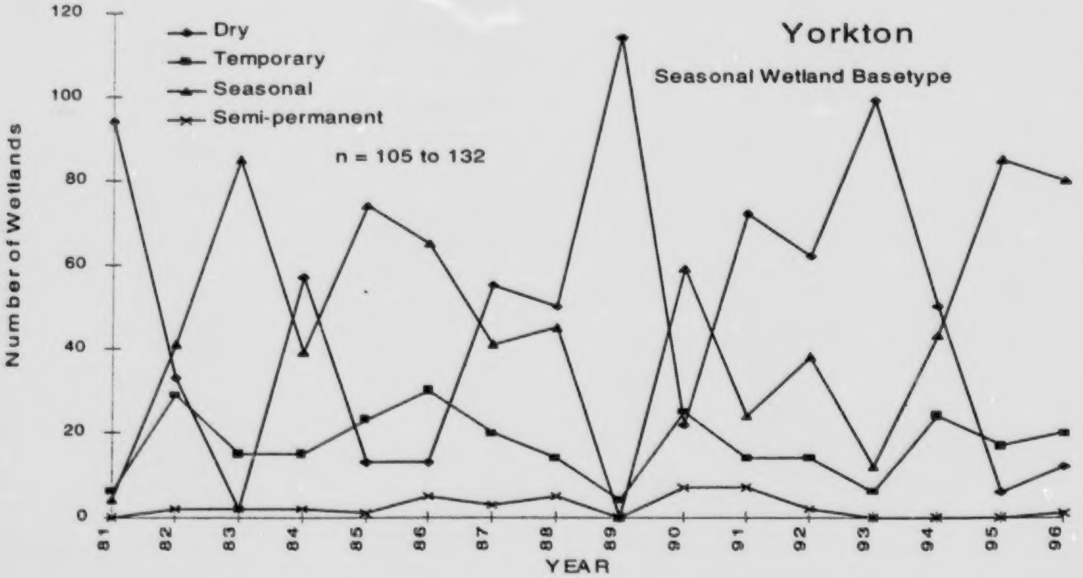
5 ground segments combined



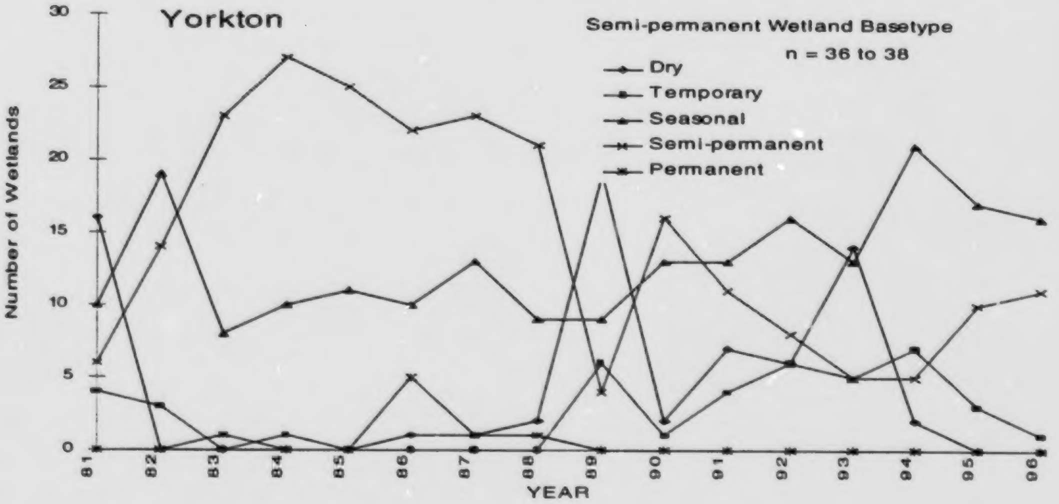
Temporary and seasonal wetlands are the most abundant basetype of wetlands within the UARB. Nut Mountain is almost wholly comprised of these two wetland types, and temporary wetlands are about 1/2 of the wetlands of Wroxton and Penrith. Semi-permanent and permanent wetlands are relatively uncommon, with Yorkton having the greatest number of these basetypes.

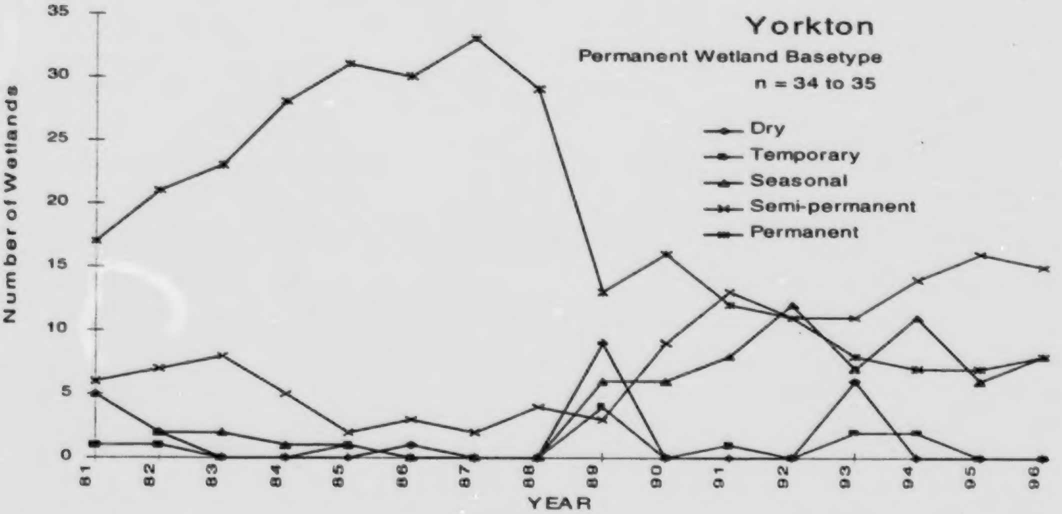
Although the basetype of a wetland represents its maximum potential, in terms of water permanency under fully supply conditions, a given wetland varies in type from year to year. Temporary wetland basetypes are usually small, shallow depressions which can quickly fill with spring run-off, and as quickly become dry or not fill if spring run-off is limited. They can become seasonal wetland basetypes in years of very high spring run-off. Seasonal wetlands tend to be somewhat larger and deeper, but these also change in type quickly in response to spring run-off conditions. They may be classified as temporary wetlands or be dry in dry years, and some may be classified as semi-permanent in very wet years.





Semi-permanent and permanent wetland basetypes also can change in type in a given year in response to spring run-off conditions. However, these wetlands are larger and much deeper and changes in type usually require major changes in spring run-off supply, or prolonged periods or drought or high water conditions. The water level stage of these wetlands more often is the most obvious change in wetland character. Water levels may range from strongly recessional to over-flowing although the type for successive years does not change.





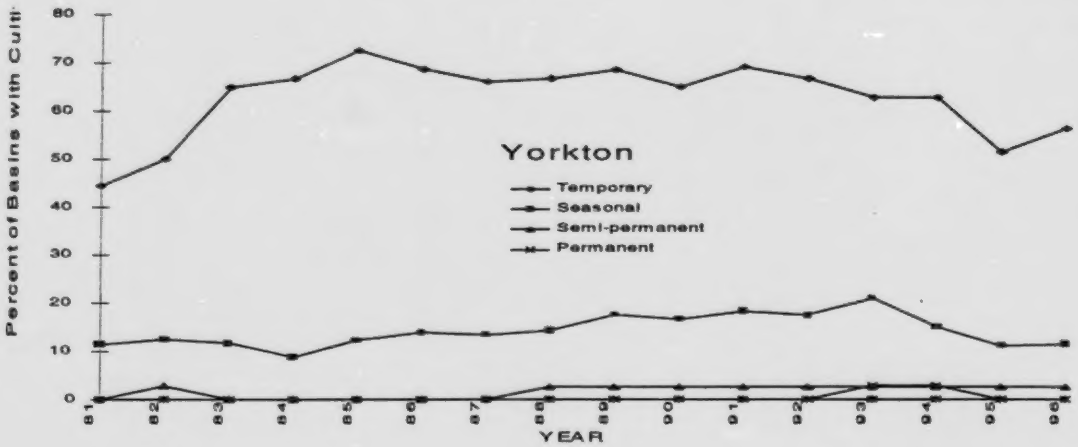
Although sample sizes are limited for permanent and semi-permanent wetland basetypes, these wetland types appear to be more frequently typed as less permanent seasonal wetlands during the 1990s when water conditions were improving. It is not clear if this represents changes to these wetlands, possiby from drainage activities, or if an insufficient period of time has elapsed for most of these wetland basetypes to recover from the drought conditions of the late 1980s.

Agricultural Impacts

Cultivation of Basins and Margins

Cultivation of natural vegetation of the basins and margins of wetlands is the most drastic impact in terms of loss of habitat for a variety of wildlife species. This impact is usually considered to be permanent in effect upon margins of wetlands. Although it is possible to replace margins through plantings of natural vegetation it is rarely undertaken, and knowledge to regenerate natural vegetation is often lacking. Cultivation of the basins of wetlands, particularly those of more water permanence, is often temporary since native wetland vegetation usually develops following several years of improved water conditions.

Ground	Average Percent of **Basins** Competely Cultivated			
Segment	Temporary	Seasonal	Semi-perm	Permanent
Yorkton	63 (44 - 73)	14 (11 - 21)	2 (0 - 3)	0 (0 - 3)
Buchanan	85 (77 - 93)	42 (27 - 56)	2 (0 - 5)	1 (0 - 7)
Penrith	87 (76 - 93)	26 (10 - 36)	4 (0 - 6)	0 (all)
Nut Mountain	52 (46 - 56)	15 (7 - 20)	0 (all)	0 (all)
Wroxton	64 (57 - 68)	11 (4 - 16)	0 (all)	0 (all)

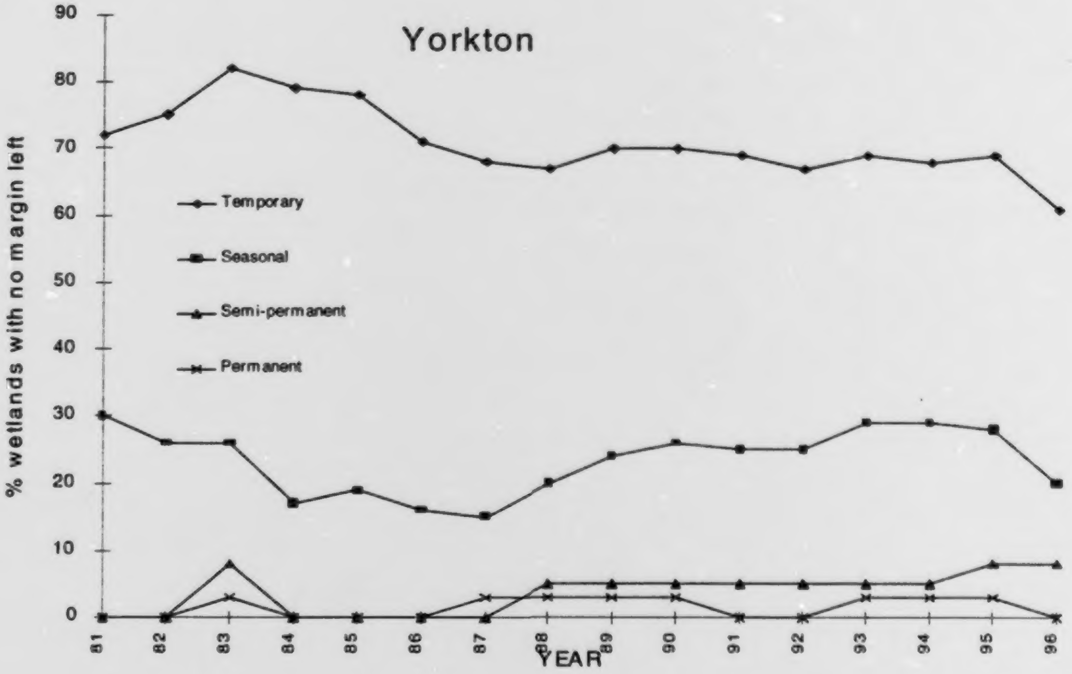


Ground	Average Percent Cultivation of Area of **Basins** Not Completely Cultivated			
Segment	Temporary	Seasonal	Semi-perm	Permanent
Yorkton	99(96-100)	99(90-100)	98(80-100)	100 (all)
Buchanan	99(97-100)	99(90-100)	98(90-100)	100 (all)
Penrith	98(97-100)	96(84-100)	none	none
Nut Mountain	99(98- 99)	96(92- 98)	none	none
Wroxton	98(97- 98)	99(99-100)	none	none

A relatively high percentage of basins are cultivated completely each year in all five ground survey segments. Buchanan appears to have particulary high rates of complete cultivation of both temporary and seasonal wetlands. Complete cultivation of basins, as expected, is more prevalent in wetland basetypes which become dry more frequently - temporary and seasonal wetlands - than in those wetland basetypes which are generally large, deeper and more permanent in nature. In most cases the entire basin is cultivated in all base types.

Margins of wetlands are particularly vulnerable to cultivation since they are not part of the wetland depression, and cropping of these soils can occur on a regular basis after natural vegetation has been cleared and removed. These margins are particularly important for many species of wildlife for their breeding and foraging. Restriction of the width of margins results in increased predation of the clutches of birds since searching by predators is simplified in the narrow remnant margins.

Ground	Average Percent of **Margins** Competely Cultivated			
Segment	Temporary	Seasonal	Semi-perm	Permanent
Yorkton	73 (61-82)	23 (15-30)	4 (0 - 8)	2 (0- 3)
Buchanan	91 (83-96)	62 (38-70)	13 (4-28)	4 (0-13)
Penrith	86 (83-95)	38 (29-49)	9 (0 - 11)	0 (all)
Nut Mountain	55 (47-59)	23 (21-25)	none	none
Wroxton	64 (63-64)	14 (10-18)	0 (all)	none



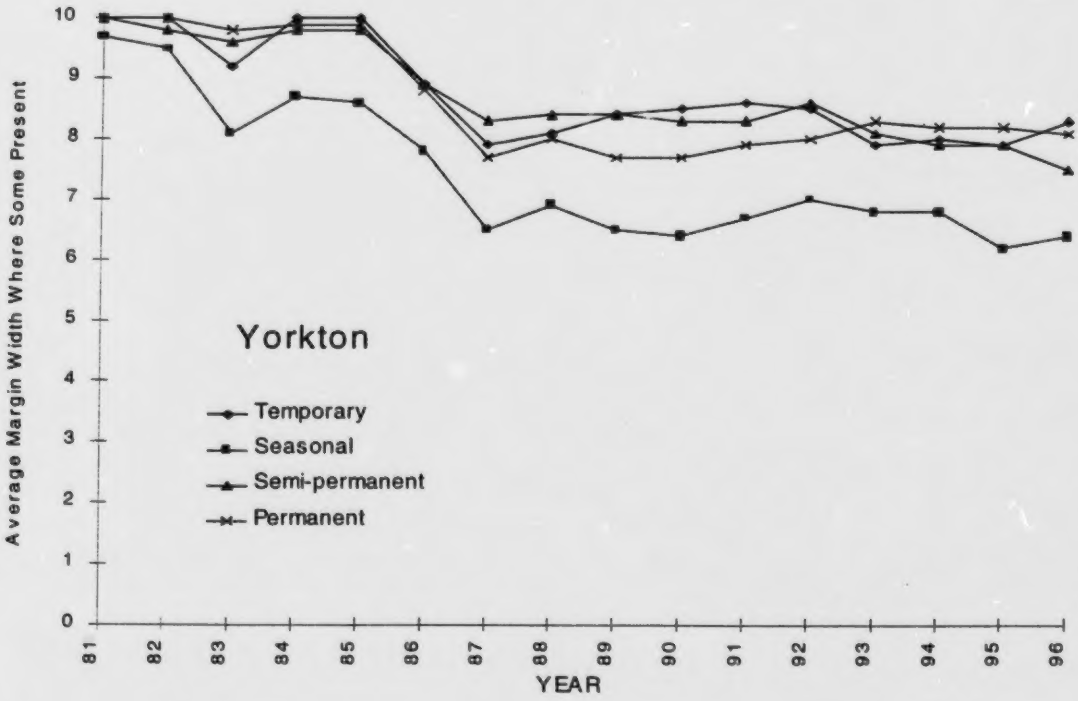
The percent of margins which have been completely cultivated has been relatively constant throughout the survey period for all five ground survey segments and for all wetland basetypes. Impacts upon wetland margins by complete cultivation have occurred well before the initiation of this habitat monitoring program. The minor variations among years probably represent minor reassessments by survey crews among years.

Complete loss of wetland margins is very typical of temporary wetlands, and to a lesser degree, seasonal wetlands. Margins of larger, deeper semi-permanent and permanent wetlands often have heavy woody vegetation and undulating terrain which makes them less vulnerable to clearing and cultivation.

For those wetlands with some margin remaining, the average margin width varies among ground survey segments, and by wetland basetype. Remnant margins are between 7 and 10 m for all wetland basetypes, suggesting that usually the margin is either cultivated or it is largely intact. It appears remant margins of temporay wetlands are somewhat larger than those of seasonal and the more permanent wetland basetypes. The reason for this is not clear.

Ground Segment	Average Width (m) of **Margins** Not Completely Cultivated Temporary	Seasonal	Semi-perm	Permanent
Yorkton	8.8	7.4	8.7	8.6
Buchanan	9.7	8.2	9.0	8.9
Penrith	7.4	7.6	8.1	10.0
Nut Mountain	8.9	8.2	none	none
Wroxton	8.2	7.9	none	none

However, there are apparent changes in average margin width over the survey period which suggest remnant margins continue to be slowly reduced in width by cultivation. For example, wetland margins appear to have been reduced for all wetland basetypes of the Yorkton ground survey segment in the 1980s, followed by relatively stable widths. At Buchanan margin widths have declined similarly for some wetland basetypes, and at Penrith there has been a progressive decline over the survey period. For most wetland types of each ground survey segment the average margin width in 1996 was 1 or 2 m less than the averages listed above.

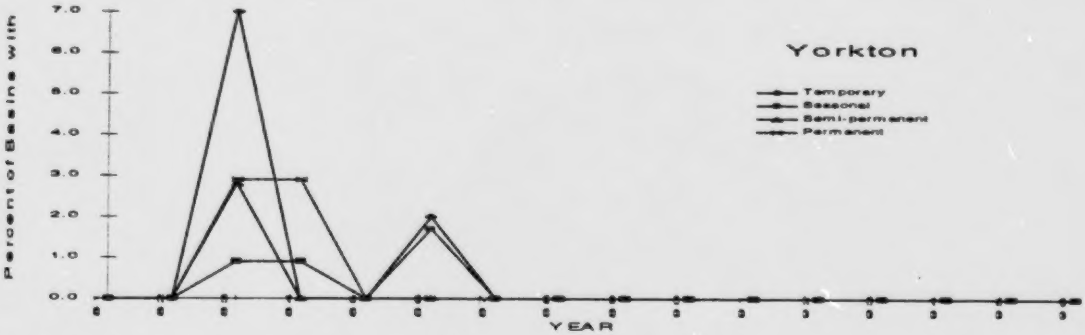


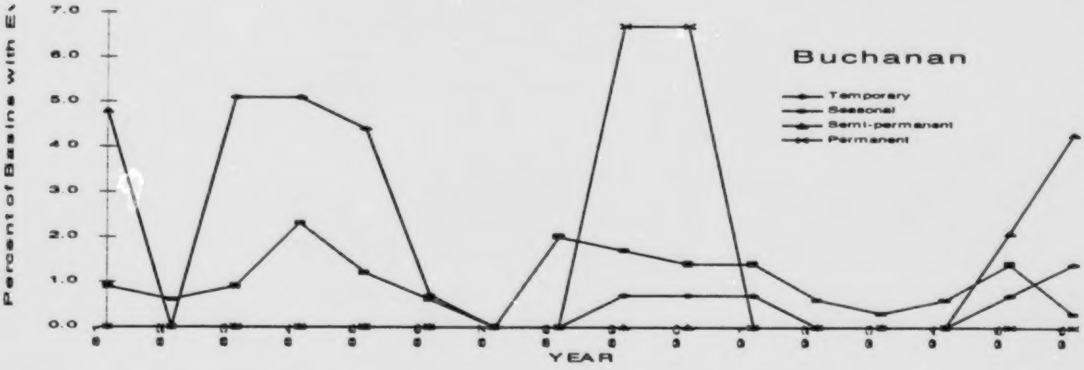
Agricultural Impacts

Drainage of Basins

Evidence of drainage, in the form of visible trenching to remove water from basins, can be difficult to detect by survey crews unless very obvious and recent. Drainage impacts upon basins appears to be relatively low for the five ground survey segments. Drainage appears to be somewhat more prevalent at Buchanan. Drainage of temporary and seasonal wetland basetypes appears to be more common, perhaps reflecting the greater ease of directing water from these shallow basins. The small number of ground survey segments may not be representative of regional draining activity, particularly if drainage is highly localized.

Ground Segment	Percent of **Basins** with Evidence of Drainage Temporary	Seasonal	Semi-perm	Permanent
Yorkton	0.6 (0 - 7)	0.2 (0 - 2)	0.2 (0 - 3)	0.4 (0 - 3)
Buchanan	1.2 (0 - 5)	1.0 (0 - 2)	0.7 (0 - 5)	0.8 (0 - 7)
Penrith	0.4 (0 - 3)	0.2 (0 - 1)	0.0 (all)	0.0 (all)
Nut Mountain	0.0 (all)	0.0 (all)	none	none
Wroxton	0.0 (all)	0.0 (all)	none	none





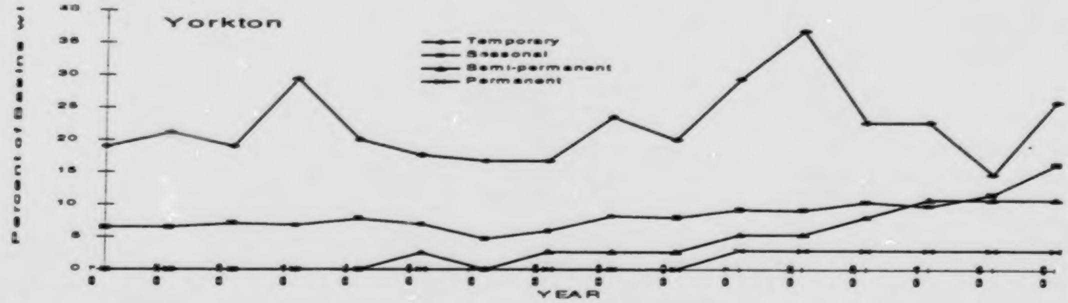
Occurrence of drainage appears to be sporadic and occurs in low frequency in some years. Drainage may be more frequent in the Buchanan area as some drainage is recorded in most years. Drainage in Yorkton has not been reported in recent years, but is starting to be recorded in the Penrith area during the last decade. More comprehensive monitoring of wetlands in more areas throughout the UARB is necessary to adequately assess the frequency and impact of drainage upon the different wetland basetypes.

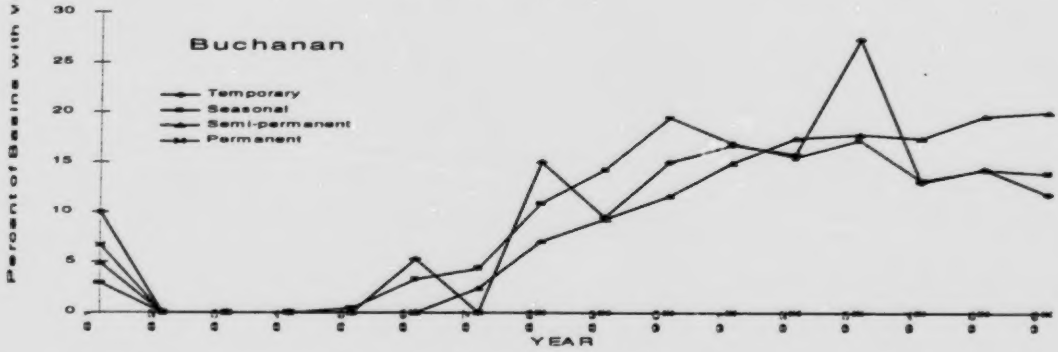
Agricultural Impacts

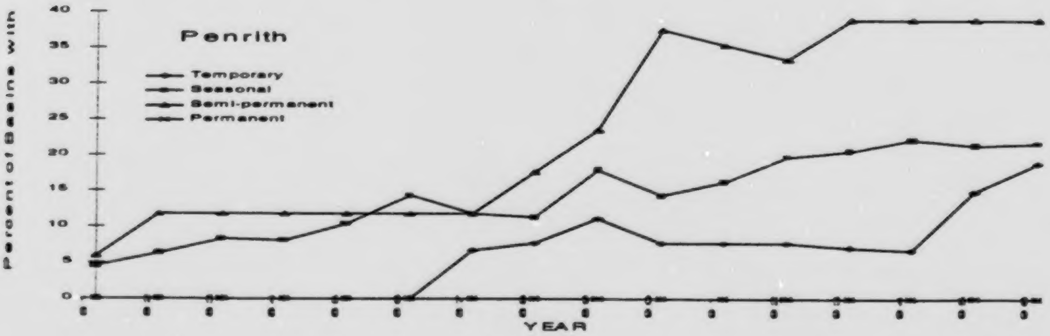
Clearing of Woody Vegetation of Basins and Margins

Clearing of the woody vegetation of basins and margins of wetlands is conducted before conversion to cultivation. The frequency of occurrence of woody vegetation in wetland basins not completely cultivated appears to be increasing for seasonal and semi-perment wetlands, and to some extent in temporary wetlands. Little change has occurred in the permanent wetlands.

Ground	Average Percent of **Basins** with Some Woody Vegetation			
Segment	Temporary	Seasonal	Semi-perm	Permanent
Yorkton	22 (17-29)	8 (5-16)	4 (0-11)	1 (0- 3)
Buchanan	10 (0-27)	9 (0-19)	9 (0-20)	.5 (0- 7)
Penrith	6 (0-19)	14 (10-22)	24 (6-39)	0 (all)
Nut Mountain	13 (11-18)	30 (25-38)	none	none
Wroxton	40 (34-50)	47 (45-50)	20 (all)	none

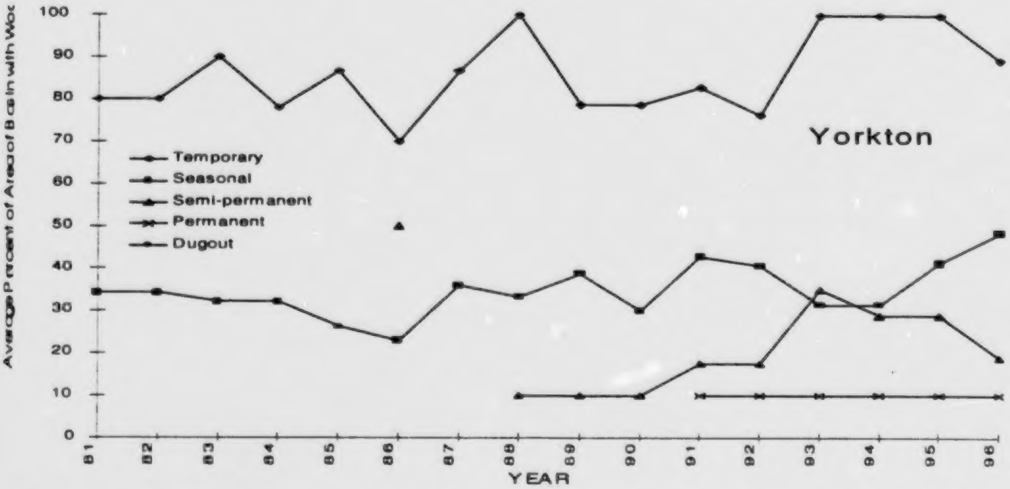


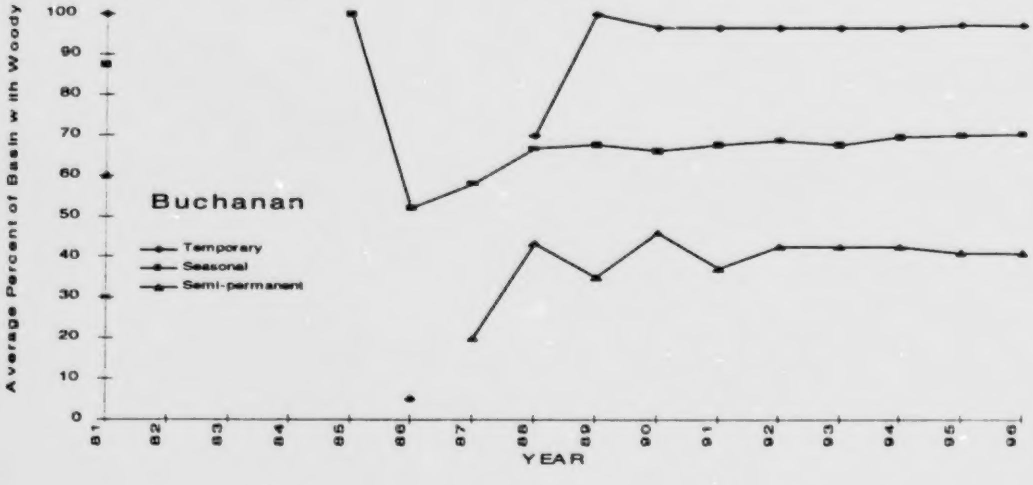




The proportion of the area of wetland basins with woody vegetation, where cultivation of of basins was not complete, varied by wetland basetype. Basins covered with a greater extent of woody vegetation were temporary wetland basetypes, followed by seasonal and then semi-permanet wetland basetypes. This illustrates the site preference of willows for the wet meadow vegetation zone of temporary wetlands, and the wet meadow zone periphery of many larger seasonal and semi-permanent wetlands. There did not appear to be any increasing coverage of basins by woody vegetation in the Yorkton, Buchanan or Penrith ground survey segments.

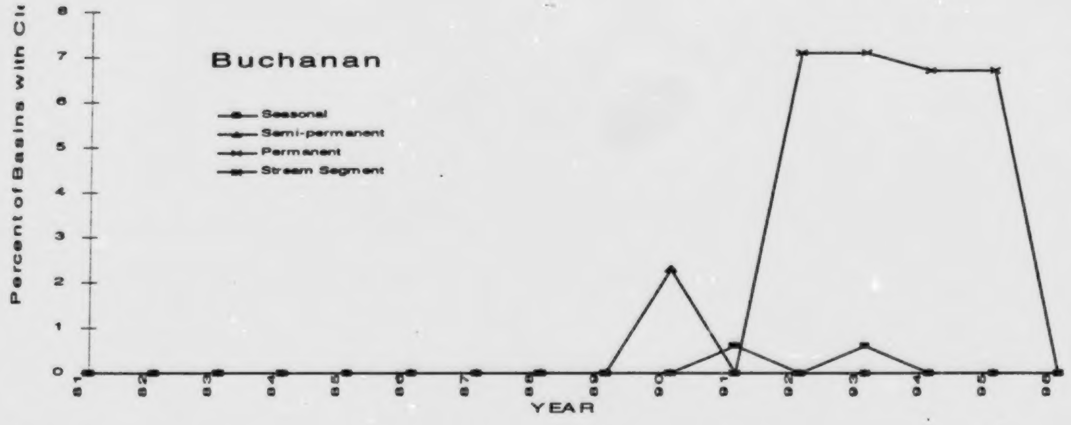
Ground Segment	Average Percent of **Area of Basins** with Woody Vegetation			
	Temporary	Seasonal	Semi-perm	Permanent
Yorkton	86 (70-100)	35 (23- 48)	23 (10- 50)	10 (all)
Buchanan	87 (70-100)	70 (52- 88)	41 (20- 46)	30 (all)
Penrith	97 (74-100)	50 (39- 61)	34 (23- 51)	none
Nut Mountain	91 (90- 93)	55 (52- 66)	none	none
Wroxton	44 (41- 53)	48 (44- 55)	30 (all)	none

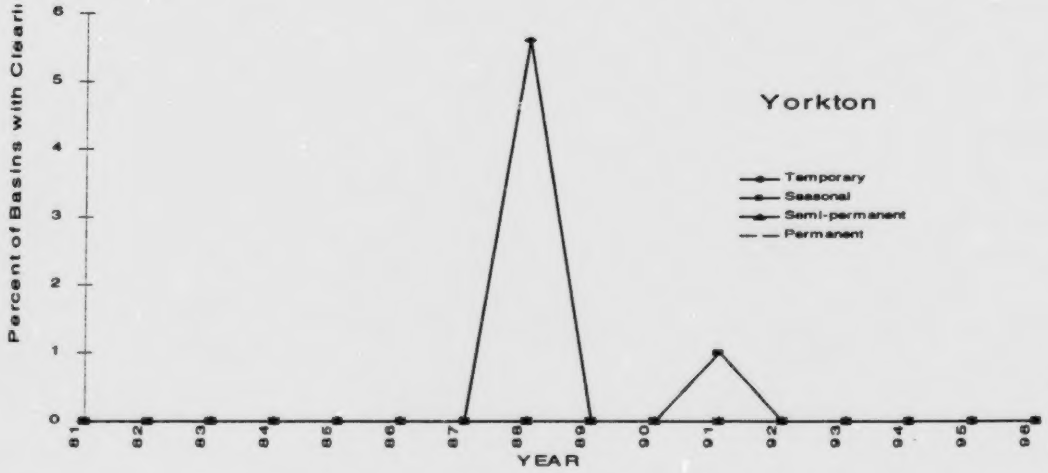




Clearing of woody vegetation within wetland basins prior to cultivation was occasionally noted. It appeared to be more frequent in the Buchanan ground survey segment, and whenever it occurred in temporary or seasonal basins the clearing was usually complete.

Ground Segment	Average Percent of **Basins** with Clearing of Woody Vegetation Temporary	Seasonal	Semi-perm	Permanent
Yorkton	0.4 (0-6)	0.1 (0-1)	0 (all)	0 (all)
Buchanan	0 (all)	0.1 (0-1)	0 (0-6)	1.7 (0-7)
Penrith	0 (all)	0 (all)	0.4 (0-6)	0 (all)
Nut Mountain	0.8 (0-2)	0 (all)	none	none
Wroxton	0.6 (0-3)	0.6 (0-3)	0 (all)	none

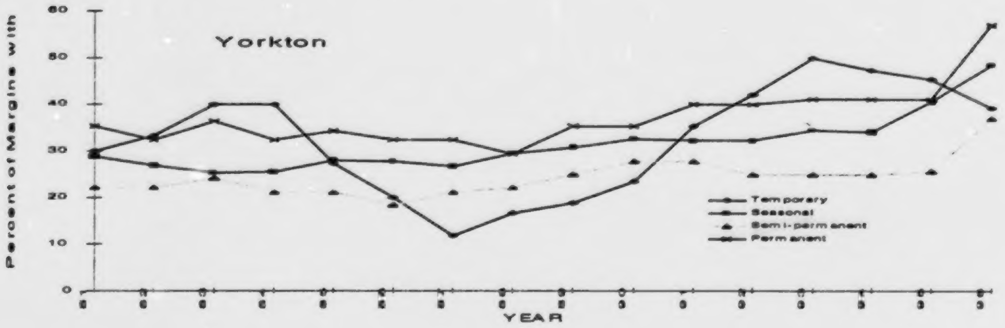


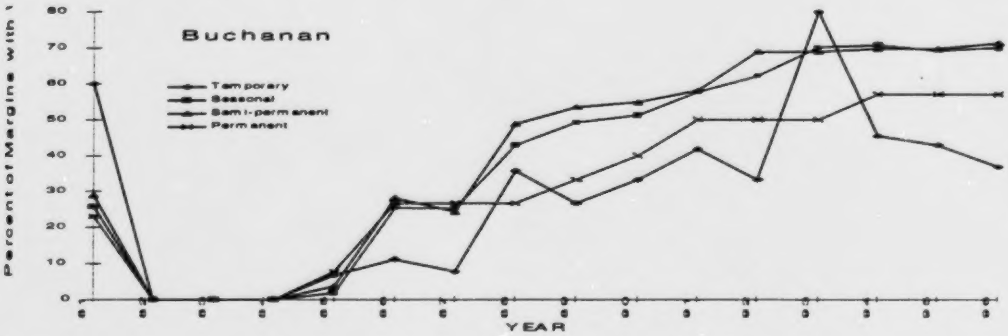


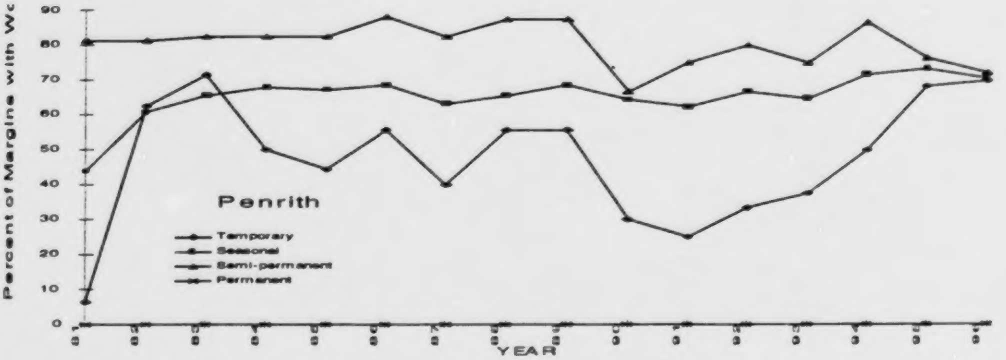
Clearing of woody vegetation from the basins of wetlands does not appear to be a common event in the UARB except possibly in local areas.

Woody vegetation along the margins of wetlands, in the form of shrubs or trees, is common in the UARB. Seasonal and semi-permanent wetland basetypes appeared to have some more woody vegetation along their margins compared to the temporary wetland basetype. Woody vegetation of margins appears to be gradually increasing at Yorkton, to be rapidly increasing at Buchanan, and to be relatively stable at Penrith.

Ground Segment	Average Percent of **Margins** with Some Woody Vegetation Temporary	Seasonal	Semi-perm	Permanent
Yorkton	33 (12-42)	32 (25-49)	24 (18-37)	37 (29-57)
Buchanan	29 (7-80)	39 (25-71)	41 (24-71)	32 (8-57)
Penrith	47 (25-71)	65 (44-74)	81 (75-88)	0 (all)
Nut Mounatin	39 (38-43)	71 (68-72)	none	none
Wroxton	67 (57-76)	74 (71-77)	80 (all)	none

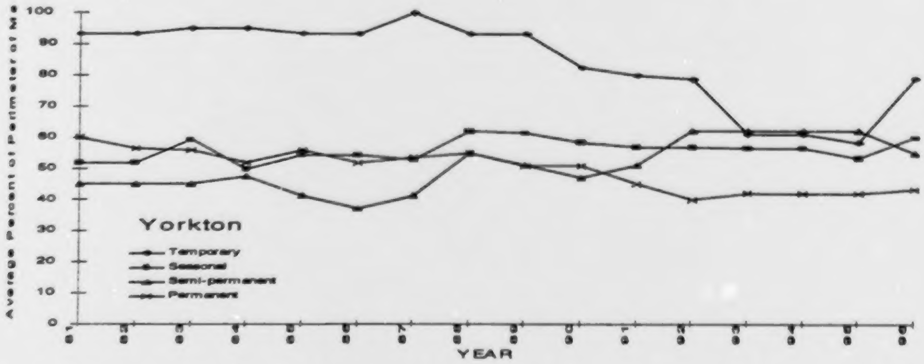


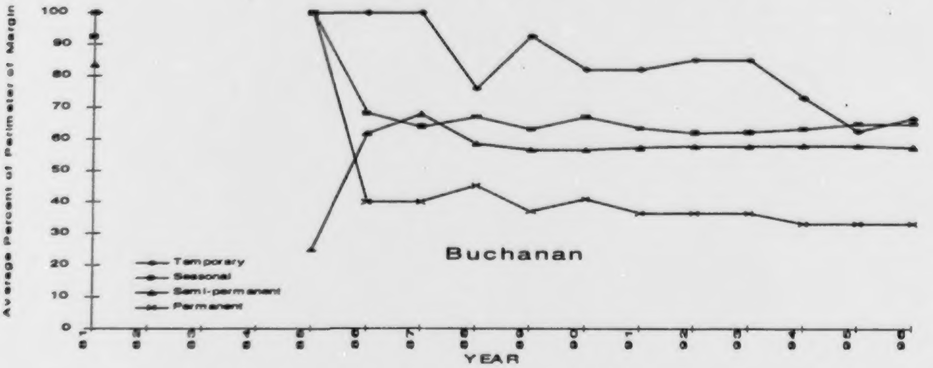


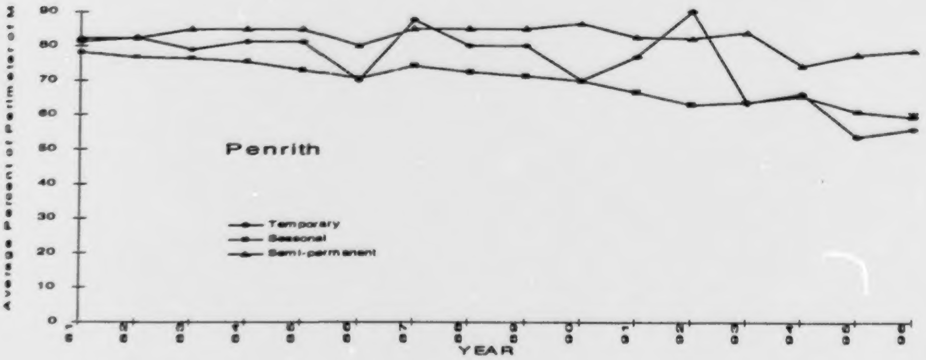


The average percent perimeter of wetland margins with woody vegetation is relatively high for all wetland basetypes in all five ground survey segments. There appears to be a gradual decline in woody vegetation around the margins of temporary wetlands.

Ground	Average Percent of **Margin** Perimeter with Woody Vegetation			
Segment	Temporary	Seasonal	Semi-perm	Permanent
Yorkton	84 (61-100)	56 (52-59)	51 (37-61)	50 (40-60)
Buchanan	85 (63-100)	69 (62-100)	58 (62-84)	47 (33-100)
Penrith	75 (54-90)	83 (74-85)	83 (74-87)	none
Nut Mountain	60 (57-63)	66 (65-70)	none	none
Wroxton	59 (56-63)	63 (59-66)	74 (71-78)	none

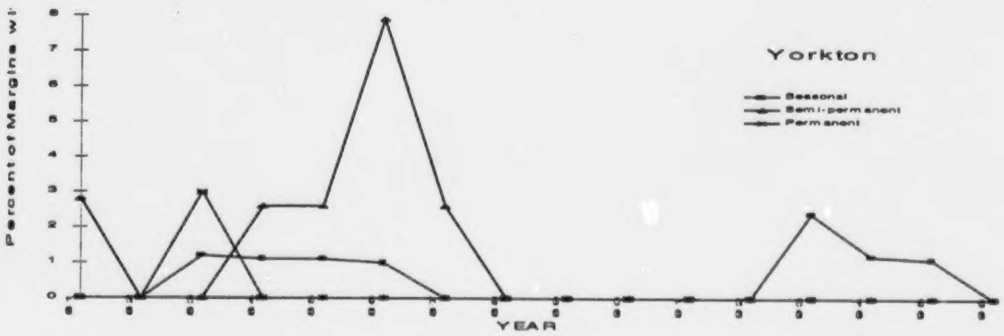


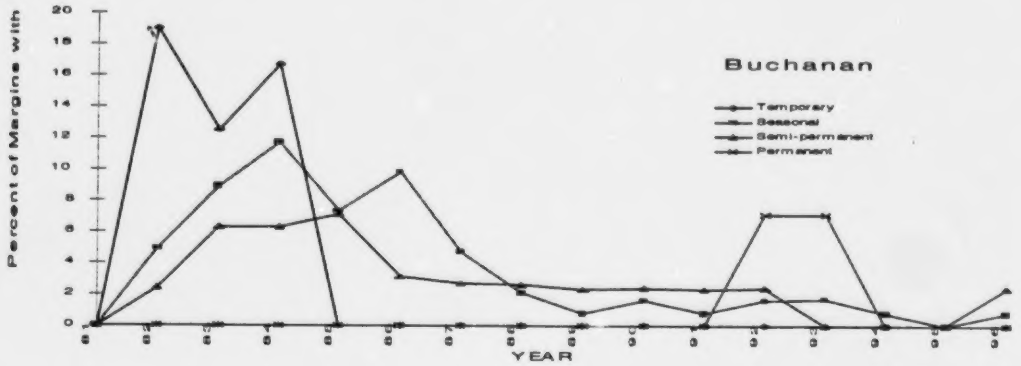


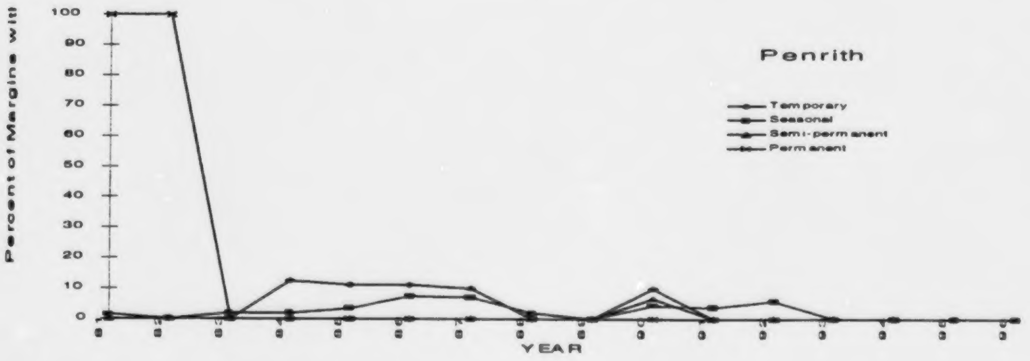


Clearing of margins appears not be be particularly common. It appears to have been more frequent in the early 1980s in the Yorkton area, more frequent at that time in the Buchanan area but with continued clearing to present, and consistently low clearing in the Perith area.

Ground Segment	Percent of **Margins** with Evidence of Clearing of Woody Vegetation Temporary	Seasonal	Semi-perm	Permanent
Yorkton	0 (all)	0.6 (0-3)	1.2 (0-8)	0.2 (0-3)
Buchanan	3.0 (0-19)	3.6 (0-12)	2.6 (0-6)	0.9 (0-7)
Penrith	3.4 (0-13)	2.4 (0-7)	0.4 (0-7)	12 (0-100)
Nut Mountain	0 (all)	2.2 (2-3)	none	none
Wroxton	2.9 (0-14)	0.7 (0-3)	8.0 (0-20)	none





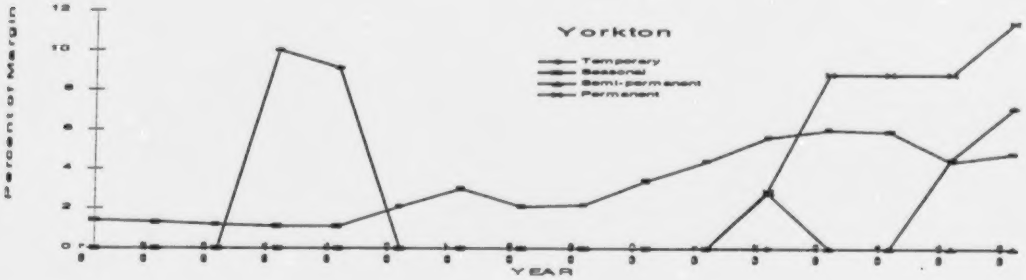


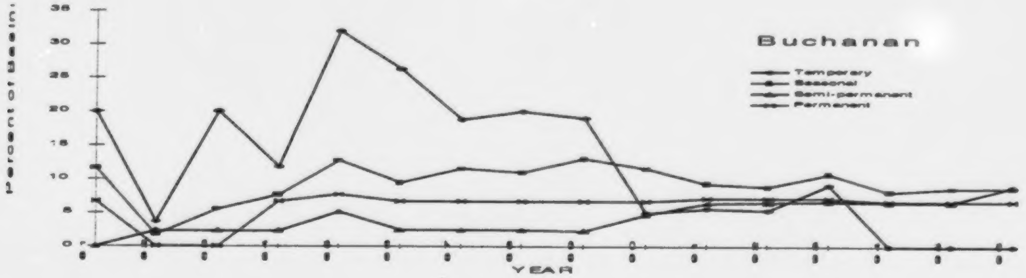
Agricultural Impacts

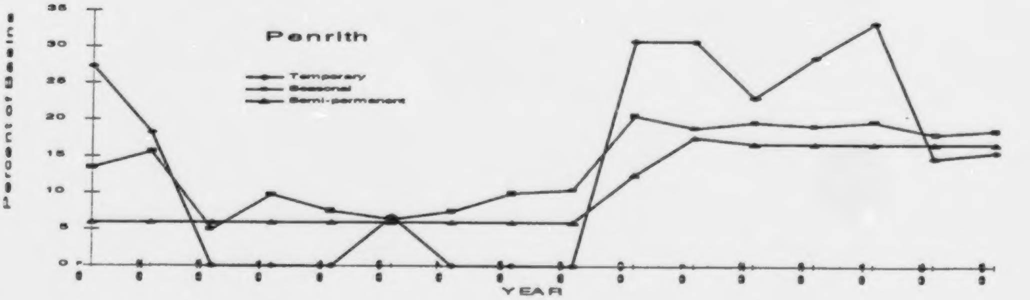
Filling of Basins and Margins

Piles of rocks from fields, refuse, and debris from clearing of woody vegetation are often found in the basins of all wetland base types. The latter is usually temporary and is eventually burned. Frequency of filling is similar among the five ground survey segments and temporary and seasonal wetland basetypes appear to be more frequently subjected to filling. Filling is variable among years and may be more frequent in the 1990s at Yorkton and Penrith. The proportion of the basin area filled (average 10 - 38%) and the greater area of basins filled are at Penrith that at Buchanan or Yorkton.

Ground	Percent of **Basins** with Evidence of Filling			
Segment	Temporary	Seasonal	Semi-perm	Permanent
Yorkton	12 (6-20)	9 (7-11)	0.3 (0-3)	2 (0-3)
Buchanan	12 (0-32)	9 (6-13)	4 (2-9)	6 (6-8)
Penrith	14(7-33)	14 (6-21)	10 (6-18)	0 (all)
Nut Mountain	2 (0-2)	11 (8-13)	none	none
Wroxton	9 (8-11)	10 (9-11)	0 (all)	none

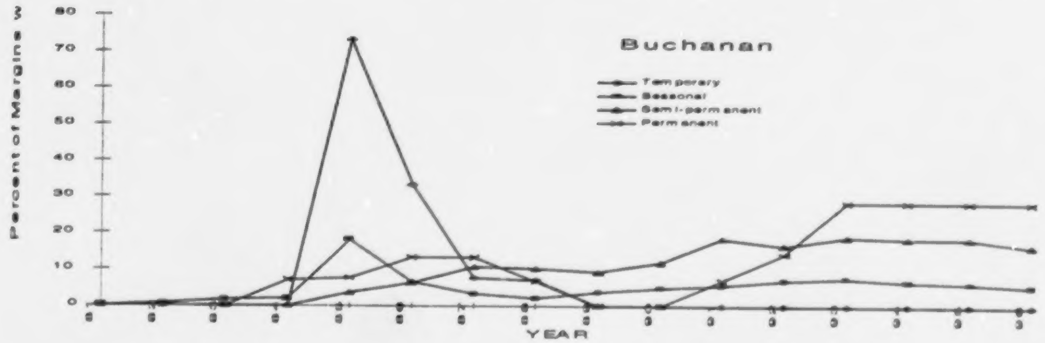


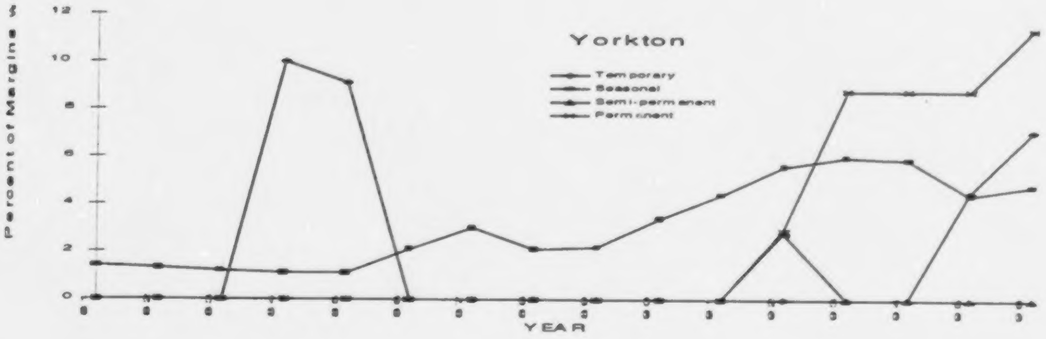




Filling in margins of wetlands was more frequent in the larger semi-permanent and permanent wetlands. There appeared to be some increase in filling of margins of these wetlands in the 1990s. However, relatively few margins had filling compared to basins.

Ground Segment	Percent of **Margins** with Evidence of Filling Temporary	Seasonal	Semi-perm	Permanent
Yorkton	1.9 (0-9)	3.1 (3-6)	0.2 (0-3)	2.5 (3-11)
Buchanan	7.6 (0-77)	5.1 (0-18)	10 (0-19)	12 (0-29)
Penrith	0.9 (0-14)	4.7 (4-13)	1.1 (0-11)	0 (all)
Nut Mountain	0.4 (0-2)	14 (12-15)	none	none
Wroxton	4.4 (4-10)	2.2 (2-3)	0 (all)	none





The average percent of filling of margins was quite variable among wetland basetype and location.

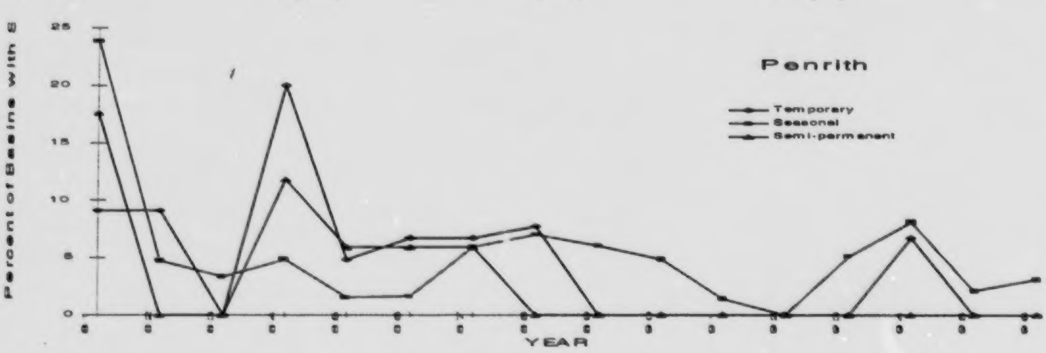
Ground Segment	Average Percent of Area of **Margin** with Filling Temporary	Seasonal	Semi-perm	Permanent
Yorkton	61 (20-100)	18 (5-50)	10 (all)	8 (5-11)
Buchanan	100 (all)	31 (5-100)	24 (13-100)	12 (5-55)
Penrith	50 (all)	22 (13-40)	26 (25-38)	none
Nut Mountain	50 (all)	24 (23-25)	none	none
Wroxton	9 (5-22)	7(5-15)	none	none

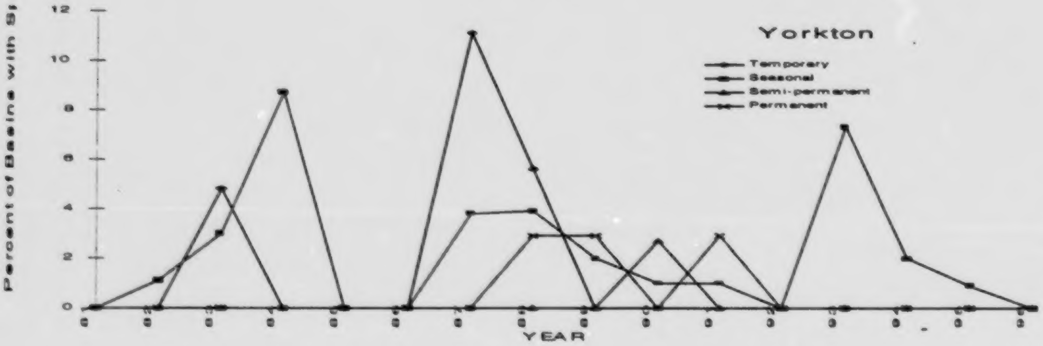
Agricultural Impacts

Burning of Basins and Margins

Relatively few basins of wetlands are burned in the spring or fall, presumably for control of weeds at wetlands in or near crops. Burning appears to be more frequent in the Penrith region but at a relatively low level. Burning in the Yortkon area appears to be more intermittent.

Ground	Average Percent of **Basins** with Burning			
Segment	Temporary	Seasonal	Semi-perm	Permanent
Yorkton	1.3 (0-11)	2.2 (0-9)	0.2 (0-3)	0.5 (0-3)
Buchanan	0.9 (0-5)	1.1 (0-5)	0.1 (0-2)	3.0 (0-14)
Penrith	4.4 (0-20)	5.2 (0-24)	2.9 (0-18)	0 (all)
Nut Mountain	0.8 (0-2)	2.0 (1-5)	none	none
Wroxton	0.8 (0-4)	1.4 (0-3)	0.0 (all)	none



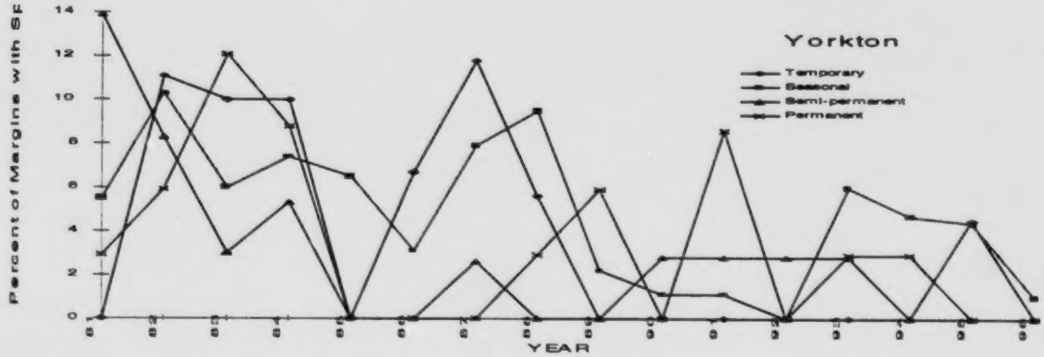


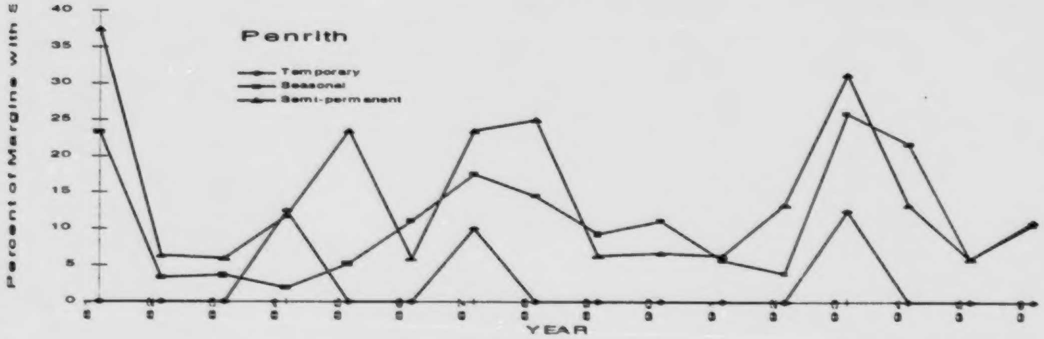
Basins tend to be totally burned, particularly the smaller temporary and seasonal wetland basetypes. Larger, more permenent wetlands may ony be partially burned. Some of this burning represents removal of debris created by clearing of woody vegetation in the basin.

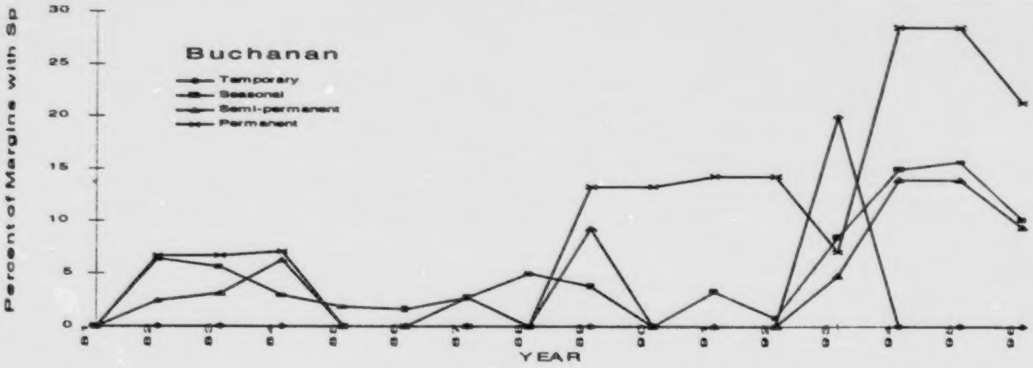
Ground	Average Percent of Area of **Basin** with Burning			
Segment	Temporary	Seasonal	Semi-perm	Permanent
Yorkton	100 (all)	91 (50-100)	none	25 (all)
Buchanan	100 (all)	86 (60-100)	100 (all)	22 (20-25)
Penrith	90 (80-100)	90 (30-100)	100 (all)	none
Nut Mountain	none	100 (all)	none	none

Margins of wetlands are also burned to remove annual weeds. Burning appears to be intermittent, and margins of more permanent wetland appear to be more frequently burned. Margins vary in the extent of burning, from 60 to 70 percent of the margin area. While burning appears to be relatively constant at Yorkton and Penrith, it appears to be increasing at Buchanan.

Ground	Average Percent of **Margins** with Burning			
Segment	Temporary	Seasonal	Semi-perm	Permanent
Yorkton	3.7 (0-12)	4.8 (0-10)	2.8 (0-14)	3.3 (0-9)
Buchanan	1.3 (0-20)	5.2 (0-16)	4.1 (0-14)	10 (0-29)
Penrith	2.2 (0-13)	11 (2-26)	15 (6-38)	0 (all)
Nut Mountain	0 (all)	16 (1-2)	none	none
Wroxton	2.9 (0-7)	2.8 (0-5)	0 (all)	none





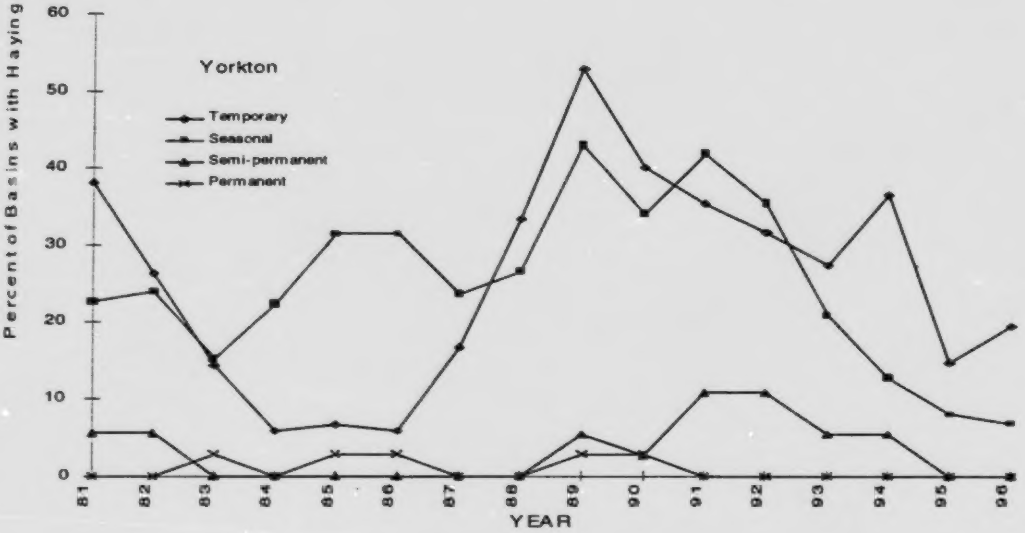


Agricultural Impacts

Haying of Basins and Margins

Basins of many temporary and seasonal basetype wetlands are hayed on a frequent basis on all five ground survey segments. Yorkton and Penrith appear to have frequent haying compared to Buchanan. Semi-permanent and permanent wetland basetypes are less subject to haying due to their greater extent of surface water and moist soils, and the peripheries of the basins of some of these wetlands may be hayed during dry years. Haying was most frequent in years of dry conditions for all wetland types and survey areas, reflecting both access to these wetlands for haying, and possibly supply of hay from forage crops in dry years.

Ground Segment	Average Percent of **Basins** with Haying Temporary	Seasonal	Semi-perm	Permanent
Yorkton	25 (6-53)	25 (7-43)	3 (0-11)	1 (0-3)
Buchanan	13 (0-28)	3 (1-7)	2 (0-5)	0 (all)
Penrith	26 (7-55)	13 (0-22)	5 (0-13)	0 (all)
Nut Mountain	33 (14-43)	2 (0-4)	none	none
Wroxton	0 (all)	1 (0-2)	0 (all)	none

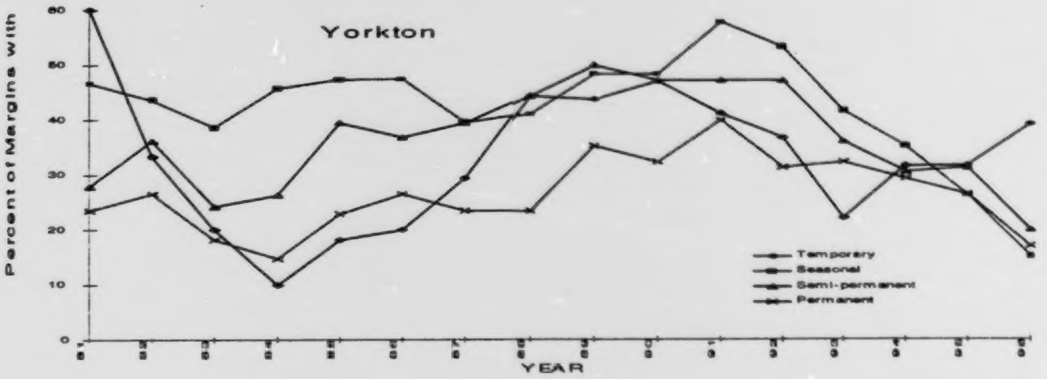


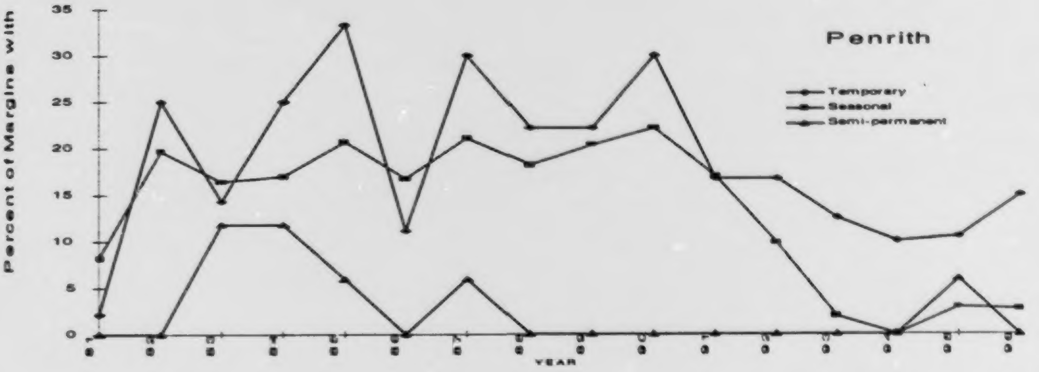
The average percent of area of the basins which were hayed was consistently high for all wetland basetypes and ground survey areas. Permanent wetlands had lower amount of haying in basins, probably reflecting haying in dry portions of these larger, more permanent basins.

Ground Segment	Average Percent of Area of **Basins** with Haying Temporary	Seasonal	Semi-perm	Permanent
Yorkton	96 (88-100)	98 (93-100)	95 (80-100)	60 (80-100)
Buchanan	100 (all)	99 (0-100)	99 (97-100)	none
Penrith	95 (90-100)	96 (70-100)	100 (all)	none
Nut Mountain	100 (all)	100 (all)	none	none
Wroxton	none	75 (50-100)	none	none

Haying of margins occurs less often in the UARB than haying of basins. This likely represents the lower suitability of many margins due to woody vegetation or irregular slopes. Haying of margins was more frequent during dry conditions of the late 1980s and early 1990s.

Ground Segment	Average Percent of **Margins** with Haying Temporary	Seasonal	Semi-perm	Permanent
Yorkton	33 (10-60)	42 (15-58)	37 (20-50)	27 (15-40)
Buchanan	21 (0-53)	6 (0-12)	4 (0-13)	2 (0-8)
Penrith	19 (2-30)	13 (0-22)	3 (0-12)	0 (all)
Nut Mountain	37 (17-40)	4 (2-6)	none	none
Wroxton	1 (0-3)	1 (0-2)	0 (all)	none





When margins are hayed in the UARB, they are usually completely hayed. This appears to be a consistent process over the survey period for all areas.

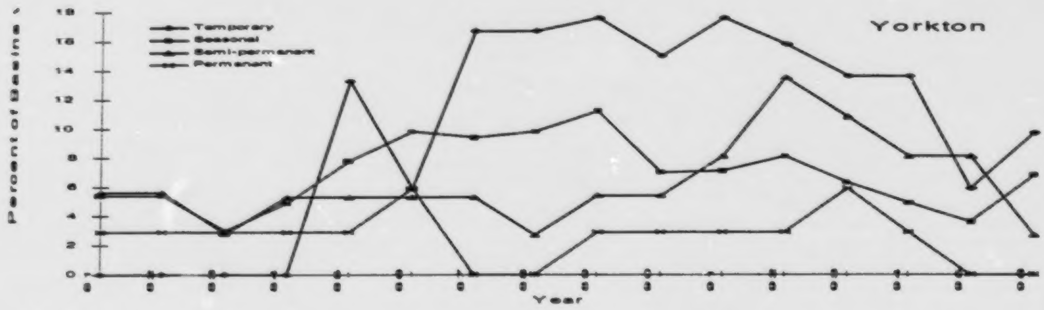
Ground Segment	Average Percent of Area of **Margins** with Haying Temporary	Seasonal	Semi-perm	Permanent
Yorkton	94 (83-100)	91 (89-94)	92 (83-100)	79 (57-95)
Buchanan	100 (all)	89 (76-100)	73 (50-100)	90 (50-100)
Penrith	91 (55-100)	90 (66-100)	100(all)	none
Nut Mountain	96 (89-100)	100 (all)	none	none
Wroxton	80 (all)	100 (all)	none	none

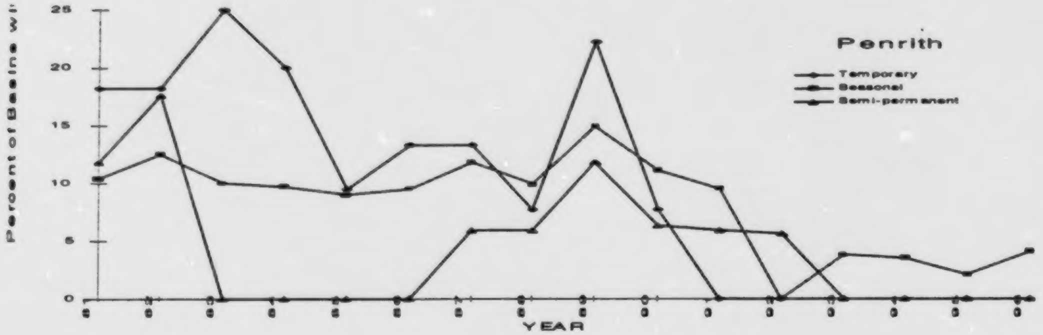
Agricultural Impacts

Grazing of Basins and Margins

Grazing occasionally occurs within basins of wetlands in the UARB, but much less often than haying. In some areas such as Yorkton grazing of basins appears to be more common during the dry periods of the late 1980s and early 1990s. In other areas such as Penrith grazing appears to be declining in occurrence over the survey period.

Ground Segment	Average Percent of **Basins** with Grazing Temporary	Seasonal	Semi-perm	Permanent
Yorkton	10 (0-17)	7 (3-11)	6 (3-14)	3 (0-6)
Buchanan	4 (0-18)	2 (1-3)	2 (0-3)	0 (all)
Penrith	10 (0-25)	8 (0-15)	4 (0-12)	0 (all)
Nut Mountain	16 (8-23)	4 (2-7)	none	none
Wroxton	11 (9-13)	4 (3-6)	0 (all)	none



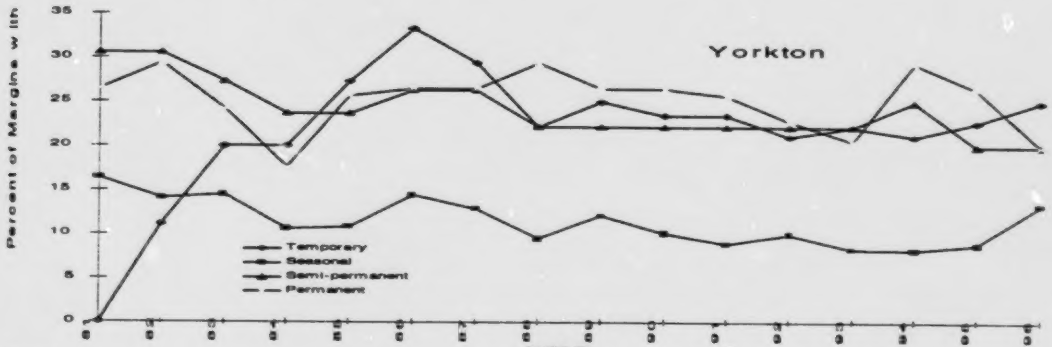


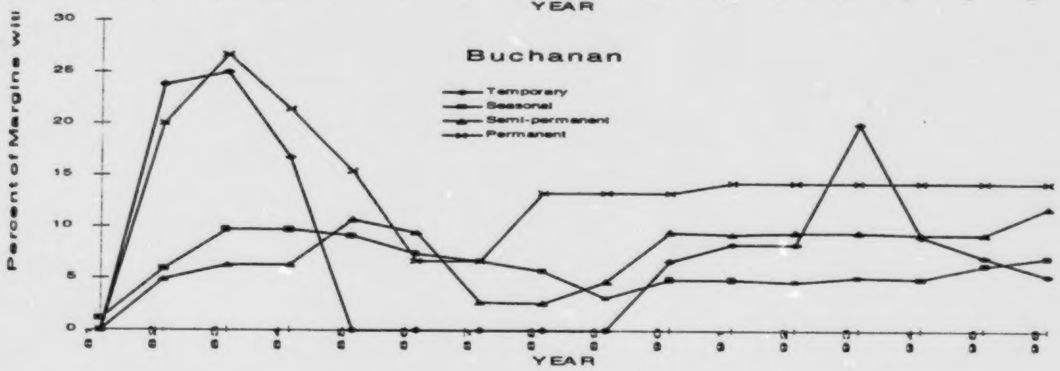
Similarly to haying most basins are completely grazed except for some semi-permanent and permanent basins where extensive surface water is present.

Ground Segment	Average Percent Area of **Basins** with Grazing Temporary	Seasonal	Semi-perm	Permanent
Yorkton	95 (75-100)	95 (82-100)	100 (all)	63 (20-100)
Buchanan	100 (all)	100 (all)	71 (20-100)	none
Penrith	100 (all)	98 (84-100)	95 (80-100)	none
Nut Mountain	100 (all)	88 (83-93)	none	none
Wroxton	100 (all)	100 (all)	none	none

Margins of wetlands are less frequently grazed which may reflect the portion of the basins dense woody vegetation. Grazing at Yorkton appeared to be fairly consistent in frequency over the survey period, and grazing at Buchanan appeared to be much higher in the early 1980s. The reason for relatively low grazing of the margins of seasonal wetland basetypes is not clear.

Ground Segment	Average Percent of **Margins** with Grazing Temporary	Seasonal	Semi-perm	Permanent
Yorkton	22 (11-33)	11 (9-16)	24 (20-31)	25 (18-29)
Buchanan	8 (0-25)	6 (3-10)	7 (3-11)	14 (13-27)
Penrith	7 (0-20)	14 (10-20)	13 (6-19)	0 (all)
Nut Mountain	20 (11-25)	17 (15-19)	none	none
Wroxton	18 (14-28)	8 (7-10)	20 (all)	none





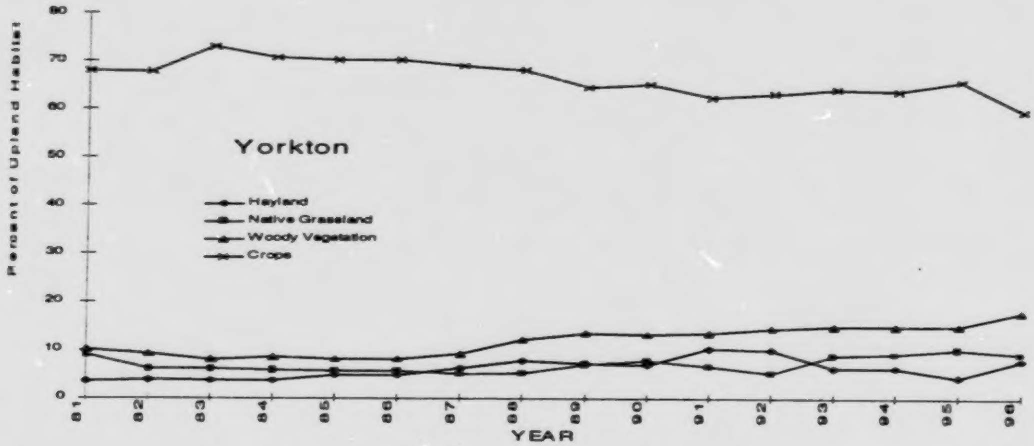
When margins were grazed most of their areas were utilized by livestock, particularly the temporary and seasonal wetland basetype margins.

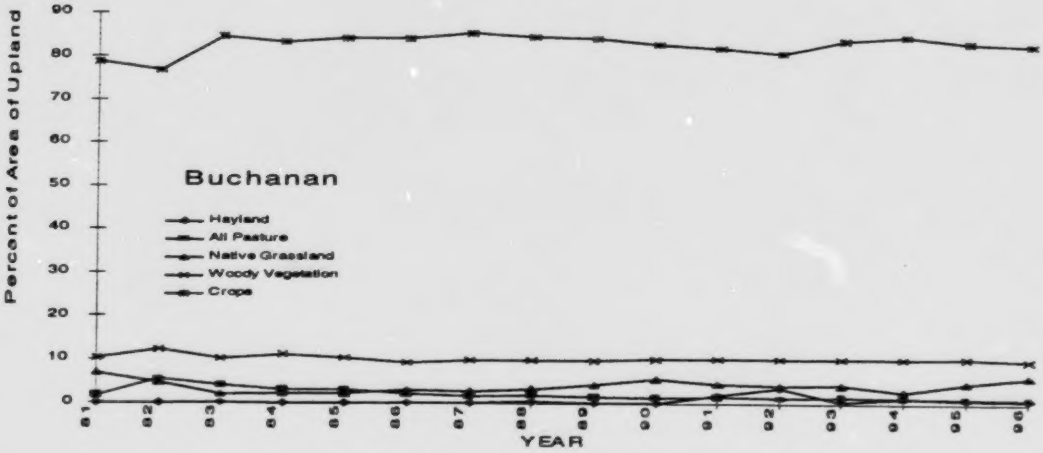
Ground Segment	Average Percent of Area of **Margins** with Grazing Temporary	Seasonal	Semi-perm	Permanent
Yorkton	94 (70-100)	97 (93-100)	99 (97-100)	94 (87-100)
Buchanan	100 (all)	98 (90-100)	89 (72-100)	82 (60-100)
Penrith	100 (all)	96 (88-100)	97 (75-100)	none
Nut Mountain	100 (all)	86 (85-87)	none	none
Wroxton	96 (91-100)	97 (94-98)	100 (all)	none

Upland Habitat Conditions

The type of upland habitat adjacent to wetland basins and their margins is important for the breeding and foraging of a variety of wildlife species. For example, many species use the wetland basins for foraging but select nest sites in both the wetland margin and adjacaent upland. In the Yorkton ground survey segment there appears to be a small but gradual reduction in the area of crop over the survey period, with a gradual and slight increase in woody vegetation. In the Buchanan ground survey segment the upland habitat types have changed very little. In the Penrith area there has been a slight increase in crop with a corresponding decrease in pasture. Changes in upland within the sampled areas of the UARB have been minimal.

Habitat Type	Average Percent of **Upland** Area with Habitat Type Yorkton	Buchanan	Penrith	Nut Moun	Wroxton
Crops	67	83	86	51	60
Hayland	6	1	1	5	1
Pasture	8	2	5	12	7
Native Grassland	7	4	3	14	15
Wooded	12	10	6	18	18





Summary

Variation is the most important principle in describing the wetland resources of the UARB. This variation is expressed by the different types of wetlands, but more importantly by the changes in their characteristics in response to moisture conditions. The degree and types of agricultural impacts upon wetlands also vary over time and among areas in response to the type of wetland, its current moisture conditions, and in some cases socio-economic factors (e.g. current availability of seeded forage crops).

An analysis of the factors, both biotic and socio-economic, which affect wetlands of the UARB would best be conducted by those who dwell in, and are familiar with, the landscapes and farming activities of the UARB. The following points summarize some aspects of the biological characteristics of wetands and their agricultural impacts based on the previous selection of tables and figures:

- Wetland numbers (basins with surface water) fluctuate greatly among years in the east-central Saskatachewan and west-central portion of Manitoba, and throughout most of prairie Canada. The small number of aerial survey segments within the UARB are insufficient to generate any accurate estimate of wetland numbers over the years. The aerial survey is designed to monitor trends in an index of wetland numbers over time over a broader scale.

- Wetland numbers (basins with surface water) similarly fluctuate greatly among years for the 5 ground survey segments within the UARB. These samples are a very small portion of the region, are centred upon areas of intensive agriculture, and may not be representative of the region. More importantly, this data base is dynamic with basins remaining even though they are almost always dry, and additional basins added by sub-division of basins during dry conditions, and the creation of artificial wetlands (e.g. dugouts). Because of these additions and no removal of basins total numbers of wetlands actually slowly increase over time for the five ground survey segments. These ground surveys were designed to monitor agricultural impacts rather than basin numbers.

- Evaluation of changes in wetland numbers may be possible by comparing recent (late 1990s) versus earlier (1984) satellite imagery to detect changes in wetland numbers during a period of increasing interest in drainage within the basin. Use of satellite imagery will not allow detection of the smaller, more temporary wetlands which, unfortunately, are often those most at risk from drainage. Photo-interpretation, if suitable imagery is available, may be the best approach to document changes in wetland numbers, over time.

- Wetland numbers, in terms of dry basins versus those with at least some surface water in May, fluctuate greatly among years. Spring run-off is the most important influence upon wetlands and their holding of surface water in the spring. Many other factors, including adjacent land cover, soil type, timing of frost, prior water conditions, and April and May temperature and precipitation, all affect spring run-off and supply level in wetlands.

- Because of the variable supply of spring run-off wetlands can vary in their classification between years based on water permanence estimate for the given year. The use of a wetland basetype, which represents the maximum permanence of a basin, is a useful means of allowing a description of wetlands, and their agricultural impacts. Within the UARB the temporary and seasonal wetland basetypes comprise over 80% of the wetlands, with minor numbers of semi-permanent and permanent wetlands, stream segments, and some artificial wetlands such as dugouts and borrow pits. Some areas, such as Yorkton, have many of the more permanent wetland basetypes. And others, such as Nut Mountain, have very few or none of the more permanent wetlands.

- The seasonal and semi-permanent wetland basetype are the most dynamic wetlands in terms of potential for change in type between years. The temporary wetland basetype is usually a temporary type or dry. The permanent wetland basetype usually remains a permanent type, but with significant recession of water level, or may become a semi-permanent type. Over prolonged periods of drought some can actually become dry.

- Many basins of temporary wetlands are completely cultivated, and of those with some basin or margin left the area cultivated is high. Seasonal wetlands are less subject to complete cultivation of the basin, and very few semi-permanent and permanent wetlands are completely cultivated. The presence of surface water, or very moist soil, limits cultivation of these more permanent basins except after periods of prolonged drought.

- Margins of many temporary and seasonal wetlands are also completely cultivated, and those do not have large portions of their areas cultivated. There appears to be a gradual attrition of the margins of all remaining wetland base types over time.

- Drainage of water from the basins of wetlands is often difficult to detect. Drainage appeared to occur on occasion in the UARB at all wetland base types. Drainage did not appear to occur after the late 1980s in the Yorkton area, is recently occurring in the Penrith area, and has been regularly occurring in the Buchanan area.

- Some wetland basins in the UARB have had their woody vegetation removed. When this occurs, usually most or all of the woody vegetation is removed. Clearing appears to be frequent in the Buchanan area in the 1990s. However, woody vegetation appears to be increasing in basins of the UARB for most types of wetland basetype, suggesting that the amount of clearing of woody vegetation is not exceeding new growth.

- Similarly many margins of wetlands of the UARB have increasing amounts of woody vegetation. Clearing continues to occur in all areas, particularly in the Buchanan area, but growth of vegetation may exceed that cleared.

- Filling in wetland basins and margins (stones, refuse, woody debris from clearing) may be increasing in the 1990s in some areas such as Yorkton and Penrith but it involves relatively few wetlands, and a small proportion of the basin and margin areas.

- Burning of basins and margins to remove weeds occurs regularly at wetlands within the UARB but relatively few wetlands are affected. Burning may be increasing in the Buchanan area.

- Haying of the basins and margins of wetlands is common within the UARB. It appears to be more common in basins in dry periods which may reflect access to this vegetation, and perhaps reduced availability of tame forage.

- Grazing of basins and margins of wetlands also occurs commonly within the UARB. No distinct pattern related to moisture conditions or wetland type is evident.

- Upland habitat adjacent to wetlands is dominated by crop. There is very little fluctuation in habitat type between years. There is some suggestion of a decrease in crop with corresponding increase in wooded habitat in the Yorkton area, and perhaps a slight increase in crop in the Penrith area where the amount of pasture may be declining.

Appendix III

Landscape Units - Land Cover

Landscape Units - Land Cover

These tables show the percentage of uplands and wetlands cover in each landscape unit, the number of quarter sections of upland and wetland habitat in each landscape unit by category (low, medium, high), and the number of hectares of each type of land cover in the landscape units.

In Tables 1 and 2, the abbreviations shown below are used to reference the wildlife habitat values.

Category	Value of Habitat for Wildlife
UL	uplands low
UM	uplands medium
UH	uplands high
WL	wetlands low
WM	wetlands medium
WH	wetlands high

Table 3 summarizes information on land cover for the landscape units. Following is the reference for the data shown in the table.

Category	By Landscape Unit
count	number of units of land cover type
hectares	total area of land cover type
minimum	minimum area of land cover type; The minimum size of the data image that can be identified from the WGTPP satellite imagery is 0.09 hectares. Parcels smaller than 0.09 hectares are not identified.
maximum	maximum area of land cover type
mean	average area of land cover type
density	average number of land cover units per square kilometre

Table 1 - Percentage of Uplands and Wetlands Habitat in Landscape Unit by Category

Landscape	UL_WL	UL_WM	UL_WH	UM_WL	UM_WM	UM_WH	UH_WL	UH_WM	UH_WH
1	0.50	0.25	0.12	1.73	0.75	1.14	26.02	45.23	24.27
36	39.50	1.68	0.26	28.55	3.46	0.44	17.15	5.38	3.60
10	12.02	3.23	0.85	16.27	7.17	2.98	28.60	21.72	7.16
35	22.51	0.53	0.00	31.07	1.07	0.53	35.86	7.36	1.07
33	26.15	0.26	0.00	33.53	0.86	0.00	36.35	2.48	0.36
34	33.39	14.41	4.00	28.87	5.34	2.67	11.31	0.00	0.00
30	60.17	1.05	2.62	25.42	0.90	1.58	5.48	1.28	1.50
26	53.13	1.44	0.11	26.33	3.79	0.21	11.37	3.41	0.21
5	4.88	1.22	32.92	4.88	2.44	14.64	7.32	8.54	23.17
27	30.39	11.15	0.72	23.71	13.14	1.98	11.63	6.57	0.72
19	41.21	2.00	0.34	26.71	3.45	0.04	18.76	7.34	0.15
2	0.73	0.36	0.00	1.37	2.09	0.48	44.79	40.03	10.15
31	3.33	3.36	33.36	3.34	3.32	10.00	19.96	16.65	6.67
28	5.98	0.17	0.17	14.42	1.63	0.26	67.10	9.25	1.03
32	29.01	2.64	26.30	5.25	21.09	15.70	0.00	0.00	0.00
4	1.47	0.00	1.11	4.79	2.57	2.22	47.93	29.57	10.34
8	2.11	0.32	18.47	2.60	0.32	7.46	31.94	17.98	18.78
29	36.77	0.65	0.48	32.66	4.79	0.32	17.86	6.00	0.48
6	24.02	14.10	0.26	17.95	16.54	0.26	13.64	12.20	1.03
7	8.25	0.62	0.15	15.26	4.70	0.00	48.72	21.91	0.39
11	7.35	0.58	0.07	19.71	1.97	0.10	61.78	7.66	0.78
18	0.65	0.32	9.28	2.27	0.97	7.32	39.45	21.39	18.34
15	24.10	10.66	0.35	19.01	17.30	2.61	8.90	14.06	3.00
3	0.00	0.33	0.00	0.88	0.00	0.00	37.51	42.76	18.52
14	21.19	1.73	0.08	30.94	4.45	0.30	33.26	6.85	1.19
9	7.53	1.50	0.75	19.53	8.28	2.27	31.57	21.79	6.78
25	43.61	1.84	0.12	28.95	5.37	0.61	15.25	3.88	0.37

Table 1 continued - Percentage of Uplands and Wetlands Habitat in Landscape Unit by Category

Landscape	UL_WL	UL_WM	UL_WH	UM_WL	UM_WM	UM_WH	UH_WL	UH_WM	UH_WH
24	38.10	10.87	0.00	23.08	8.83	0.33	12.81	5.22	0.77
20	65.54	2.15	0.00	16.12	3.96	0.00	8.27	3.95	0.00
13	10.62	2.89	1.19	14.08	10.02	4.42	18.12	25.56	13.10
23	20.77	0.66	0.00	39.31	1.21	0.22	35.62	1.99	0.22
37	0.00	0.00	0.00	7.38	4.39	1.31	48.35	29.26	9.31
22	73.08	2.42	0.30	14.77	1.58	1.20	4.61	2.03	0.00
12	11.93	1.93	0.17	42.41	7.21	1.53	25.19	7.94	1.70
17	8.25	0.54	0.00	49.59	2.62	0.00	36.57	2.42	0.00
21	58.37	3.06	0.00	20.63	4.47	0.42	9.43	3.53	0.10
16	53.14	17.90	0.00	10.75	5.72	0.35	7.88	3.20	1.07

Source: WGTPP Landcover

Table 2 - Number of Quarter Sections of Upland and Wetland Habitat in Landscape Unit by Category

Landscape	FUL_WL	FUL_WM	FUL_WH	FUM_WL	FUM_WM	FUM_WH	FUH_WL	FUH_WM	FUH_WH
1	4	2	1	18	6	11	221	406	218
36	479	23	4	350	43	5	211	68	53
10	132	31	8	174	72	28	299	220	69
35	43	1	0	60	2	1	73	17	4
33	527	5	1	664	18	0	727	56	11
34	35	11	3	27	4	2	10	1	0
30	846	15	36	363	15	25	86	17	22
26	1555	46	3	775	122	7	350	106	6
5	5	1	27	4	3	12	7	7	19
27	190	64	4	140	74	11	71	40	4
19	427	21	3	283	34	1	199	74	5
2	8	4	0	17	20	4	403	365	90
31	1	1	11	2	1	3	10	5	3
28	87	2	2	179	21	3	823	119	13
32	14	1	10	5	8	6	0	1	0
4	4	0	3	16	7	6	143	86	28
8	10	1	58	9	1	23	108	56	58
29	242	6	3	212	33	2	118	39	3
6	110	57	1	81	70	1	63	57	4
7	116	9	2	203	62	0	638	289	5
11	302	24	3	810	81	4	2539	315	32
18	5	1	29	24	4	23	190	71	58
15	741	308	10	571	499	76	274	410	86
3	0	1	0	3	0	0	65	64	29
14	282	23	1	425	59	4	449	94	16
9	12	2	1	29	11	3	47	30	9
25	373	17	1	252	50	7	134	37	5

Table 2 continued - Number of Quarter Sections of Upland and Wetland Habitat in Landscape Unit by Category

Landscape	FUL_WL	FUL_WM	FUL_WH	FUM_WL	FUM_WM	FUM_WH	FUH_WL	FUH_WM	FUH_WH
24	129	38	0	77	28	1	47	16	3
20	195	9	0	50	14	1	24	11	0
13	76	17	7	98	62	26	114	157	79
23	203	6	0	370	11	3	327	19	3
37	0	0	0	17	7	3	102	59	19
22	271	9	1	58	8	4	22	9	0
12	156	24	3	530	87	18	334	99	20
17	37	2	0	195	12	0	150	14	0
21	604	34	0	218	46	4	96	35	1
16	154	50	0	31	16	1	29	10	3

Source: WGTPP Landcover

Table 3 - Summary of Landscape Units by Land Cover Type

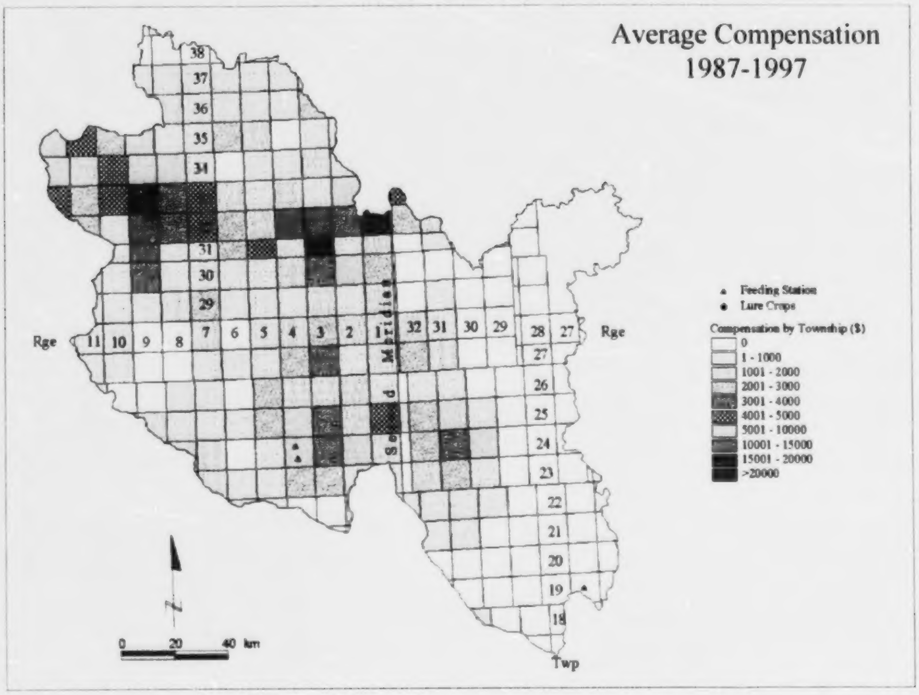
Landscape	GRASSCNT	GRASSHA	GRASSMIN	GRASSMAX	GRASSMEAN	GRASSDEN	SHRUBCNT	SHRUBHA	SHRUBMIN	SHRUBMAX	SHRUBMEAN	SHRUBDEN
1	368	4070.34	0.09	348.57	11.06	0.6926	1378	1976.04	0.09	43.92	1.43	2.5937
36	1380	3860.73	0.09	563.04	2.80	1.8238	2750	3478.59	0.09	64.53	1.26	3.6344
10	3268	14573.97	0.09	1581.75	4.46	5.2703	3995	6210.27	0.09	607.59	1.55	6.4427
35	82	1762.92	0.09	344.88	21.50	0.6656	704	1028.79	0.09	28.53	1.46	5.7145
33	557	11024.91	0.09	3187.71	19.79	0.4366	6695	12745.53	0.09	286.92	1.90	5.2483
34	19	35.73	0.18	9.18	1.88	0.3830	158	223.20	0.09	19.89	1.41	3.1851
30	107	2232.90	0.09	906.93	20.87	0.1221	2581	4064.67	0.09	49.41	1.57	2.9452
26	8232	17665.29	0.09	771.84	2.15	4.3398	4790	3529.26	0.09	40.32	0.74	2.5252
5	36	918.99	0.09	293.22	25.53	0.6697	166	194.94	0.09	13.23	1.17	3.0881
27	2531	4583.61	0.09	1031.22	1.81	6.8175	770	412.29	0.09	8.64	0.54	2.0741
19	3381	6700.95	0.09	249.75	1.98	5.5995	1932	1674.27	0.09	67.59	0.87	3.1997
2	2178	9009.99	0.09	3309.75	4.14	4.0080	3846	1903.68	0.09	106.29	0.49	7.0776
31	37	280.17	0.09	178.02	7.57	1.8596	73	112.50	0.09	13.68	1.54	3.6690
28	4913	30109.32	0.09	5951.52	6.13	6.3101	10133	9717.48	0.09	207.18	0.96	13.0144
32	0	0.00	0.00	0.00	0.00	0.000	105	128.79	0.09	8.64	1.23	4.1954
4	1859	7612.83	0.09	2087.28	4.10	10.3328	2769	3890.34	0.09	699.12	1.40	15.3908
8	853	5636.25	0.09	987.12	6.61	4.1276	1813	1830.78	0.09	58.32	1.01	8.7730
29	2506	4562.10	0.09	217.98	1.82	5.9933	2810	2092.95	0.09	69.75	0.74	6.7203
6	1496	2682.72	0.09	188.64	1.79	5.7779	2050	1824.93	0.09	74.88	0.89	7.9176
7	5464	26450.01	0.09	5809.68	4.84	6.2859	9219	17937.81	0.09	2213.10	1.95	10.6058
11	19347.00	81630.63	0.09	12761.46	4.24	6.90	8437.00	9335.25	0.09	653.94	1.12	5.70
18	1642	5782.05	0.09	321.21	3.52	7.8873	1393	2977.11	0.09	258.12	2.14	6.6912
15	14184	22298.76	0.09	328.50	1.57	7.3925	9736	6084.36	0.09	55.44	0.62	5.0743
3	289	2170.53	0.09	487.71	7.51	2.9260	0	0.00	0.00	0.00	0.00	0.0000
14	5743	19741.77	0.09	3534.84	3.44	6.4475	5071	3628.08	0.09	39.33	0.72	5.6931
9	715	2709.54	0.09	451.80	3.79	7.9972	566	549.54	0.09	45.99	0.97	6.3307
25	2579	6126.57	0.09	510.57	2.38	4.6938	1574	756.45	0.09	16.20	0.48	2.8647
24	436	1132.20	0.09	223.20	2.60	2.1719	1668	609.93	0.09	10.35	0.37	8.3091
20	796	1268.64	0.09	112.86	1.59	4.2409	568	274.86	0.09	3.60	0.48	3.0261
13	2502	13457.61	0.09	6219.36	5.38	6.3464	1619	1038.42	0.09	213.03	0.64	4.1067
23	3638	10424.25	0.09	1572.57	2.87	5.9779	4089	3089.07	0.09	122.22	0.76	6.7190
37	1360	2750.31	0.09	382.14	2.02	11.6687	0	0.00	0.00	0.00	0.00	0.0000
22	287	914.04	0.09	228.24	3.18	1.2916	747	752.22	0.09	128.88	1.01	3.3618
12	5157	14797.17	0.09	1099.17	2.87	6.5750	0	0.00	0.00	0.00	0.00	0.0000
17	8208	3163.95	0.09	115.47	0.39	32.9796	6310	1797.66	0.09	36.27	0.28	25.3534
21	501	2481.39	0.09	234.54	4.95	0.7742	4546	2908.26	0.09	45.72	0.64	7.0252
16	144	822.60	0.09	380.43	5.71	0.7636	1120	676.89	0.09	27.99	0.60	5.9391

Table 3 continued - Summary of Landscape Units by Land Cover Type

Landscape	TREECNT	TREEHA	TREEMIN	TREEMAX	TREEMEAN	TREEDEN	WETCNT	WETHA	WETMIN	WETMAX	WETMEAN	WETDEN
1	522	34430.49	0.09	23072.22	65.96	0.9825	1277	10055.25	0.09	699.39	7.87	2.4036
36	1065	7566.75	0.09	1969.29	7.10	1.4075	782	3098.52	0.09	384.12	3.96	1.0335
10	2046	4094.46	0.09	181.17	2.00	3.2996	2033	5915.61	0.09	322.47	2.91	3.2787
35	288	1691.55	0.09	191.25	5.87	2.3377	103	316.35	0.09	24.84	3.07	0.8360
33	2284	16774.29	0.09	478.53	7.34	1.7904	867	2074.68	0.09	77.67	2.39	0.6797
34	67	275.85	0.09	43.74	4.12	1.3506	34	349.29	0.45	58.32	10.27	0.6855
30	662	1689.84	0.09	118.17	2.55	0.7554	183	4349.07	0.18	3157.11	23.77	0.2225
26	1742	2547.63	0.09	57.60	1.46	0.9184	3123	4044.24	0.09	67.86	1.29	1.6464
5	58	250.74	0.09	61.47	4.32	1.0790	11	3136.14	0.45	3103.38	285.10	0.2046
27	376	556.65	0.09	34.47	1.48	1.0128	1181	2492.64	0.09	138.15	2.11	3.1812
19	1377	3514.32	0.09	521.55	2.55	2.2805	1027	1485.81	0.09	61.65	1.45	1.7009
2	1697	32388.30	0.09	10559.25	19.09	3.1229	3968	5759.64	0.09	177.57	1.45	7.3018
31	31	260.01	0.09	188.10	8.39	1.5581	4	876.51	0.90	400.59	219.13	0.2012
28	4759	10132.83	0.09	168.66	2.13	6.1123	1468	2375.55	0.09	331.11	1.62	1.8854
32	13	20.52	0.63	6.84	1.58	0.5194	8	794.88	0.45	397.71	99.36	0.3198
4	1027	1446.39	0.09	81.81	1.41	5.7083	557	2154.06	0.09	339.66	3.87	3.0965
8	989	2927.07	0.09	252.72	2.96	4.7857	575	7436.43	0.09	5153.94	12.93	2.7824
29	816	1135.35	0.09	43.56	1.39	1.9515	845	1294.47	0.09	76.68	1.53	2.0195
6	590	972.45	0.09	61.20	1.65	2.2787	1285	1923.21	0.09	48.96	1.50	4.9636
7	5162	6816.06	0.09	221.31	1.32	5.9385	3385	4085.01	0.09	49.32	1.21	3.8943
11	17076.00	108546.48	0.09	63800.91	3.93	4.79	13221.00	25361.55	0.09	6943.05	1.60	2.65
18	1432	3490.92	0.09	188.19	2.44	6.8785	400	5740.11	0.09	5273.82	14.35	1.9215
15	4533	7610.22	0.09	109.62	1.68	2.3625	10165	17089.74	0.09	279.36	1.68	5.2978
3	362	5219.82	0.09	3995.19	14.42	3.6651	453	1416.87	0.09	84.87	3.13	4.5864
14	1676	2114.01	0.09	32.76	1.26	1.8816	2138	3008.97	0.09	133.65	1.41	2.4003
9	223	432.09	0.09	54.72	1.94	2.4942	421	890.28	0.09	101.07	2.11	4.7093
25	809	1037.52	0.09	35.01	1.28	1.4724	1108	1506.60	0.09	63.63	1.36	2.0166
24	749	1712.52	0.09	70.92	2.29	3.7311	1835	1458.63	0.09	29.52	0.79	9.1422
20	225	256.41	0.09	16.20	1.14	1.1987	730	586.53	0.09	15.75	0.80	3.8892
13	630	756.54	0.09	33.03	1.20	1.5980	2072	6567.12	0.09	912.33	3.17	5.2557
23	1481	2019.60	0.09	52.38	1.36	2.4336	895	852.21	0.09	90.00	0.95	1.4707
37	1176	3914.55	0.09	2733.48	3.33	10.0900	861	1118.25	0.09	153.90	1.30	7.3871
22	58	47.97	0.09	9.72	0.83	0.2610	758	467.28	0.09	125.28	0.62	3.4115
12	3063	3580.11	0.09	117.90	1.17	3.9052	2421	3437.01	0.09	106.38	1.42	3.0712
17	1989	1500.48	0.09	71.73	0.75	7.9918	1324	500.13	0.09	15.12	0.38	5.3193
21	1611	2025.63	0.09	73.89	1.26	2.4896	1501	1495.53	0.09	47.52	1.00	2.3197
16	441	501.48	0.09	25.02	1.14	2.3385	987	805.86	0.09	12.24	0.82	5.2334

Appendix IV

Waterfowl Damage Compensation
Upper Assiniboine River Basin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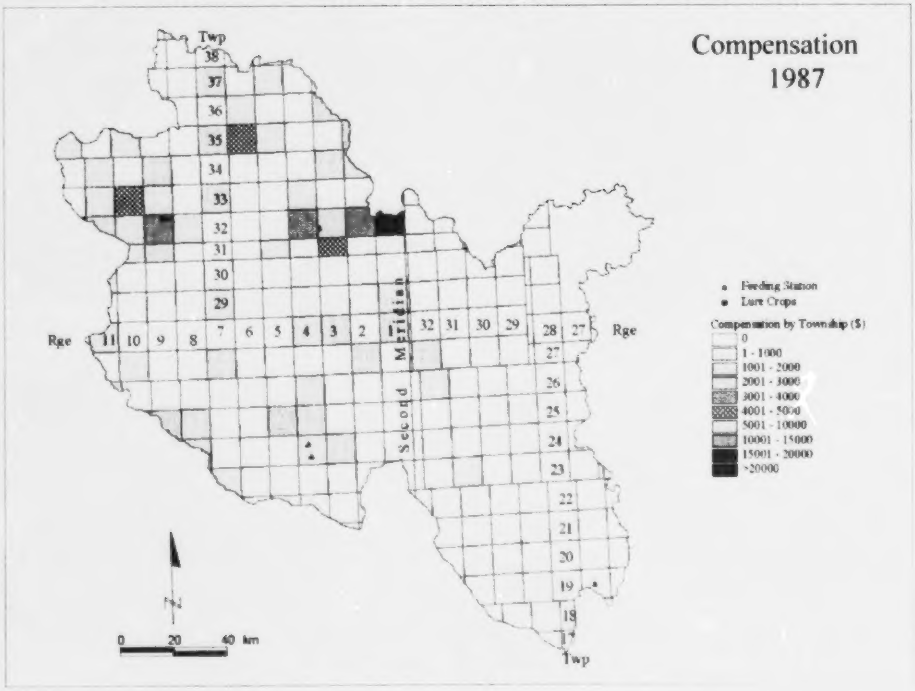
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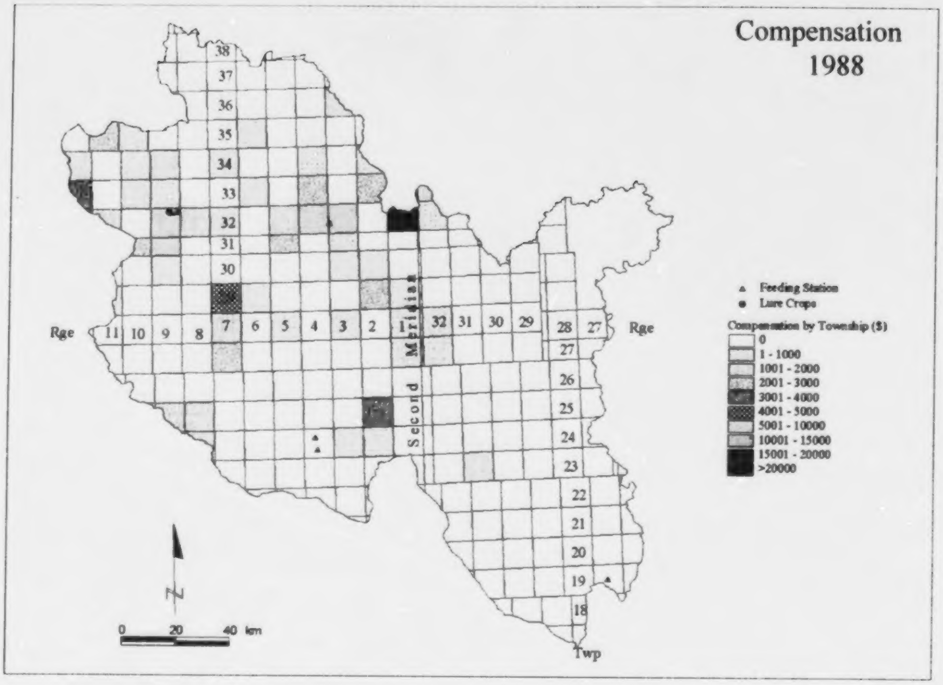
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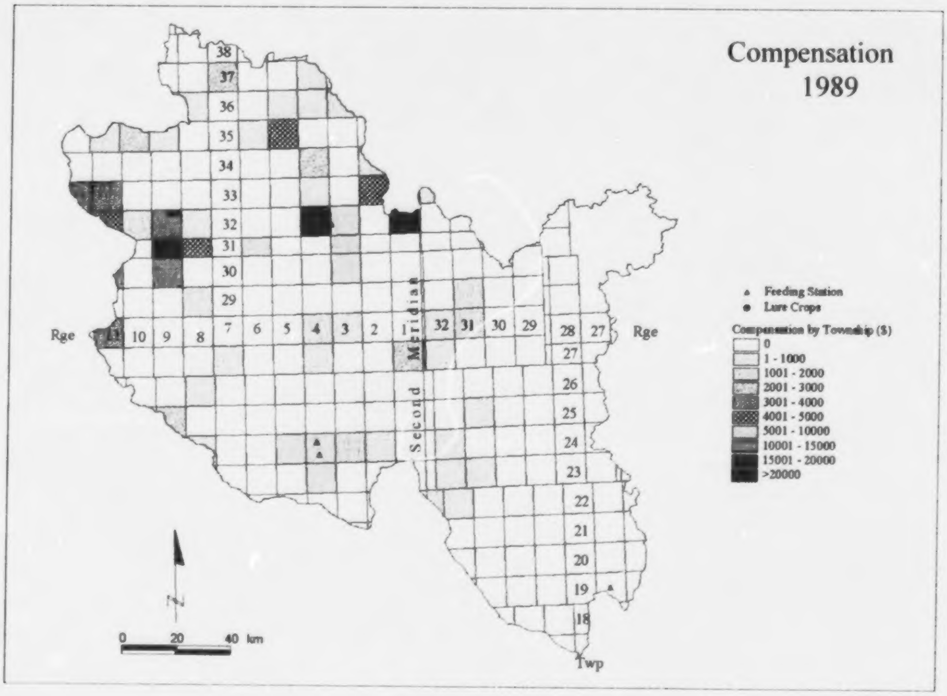
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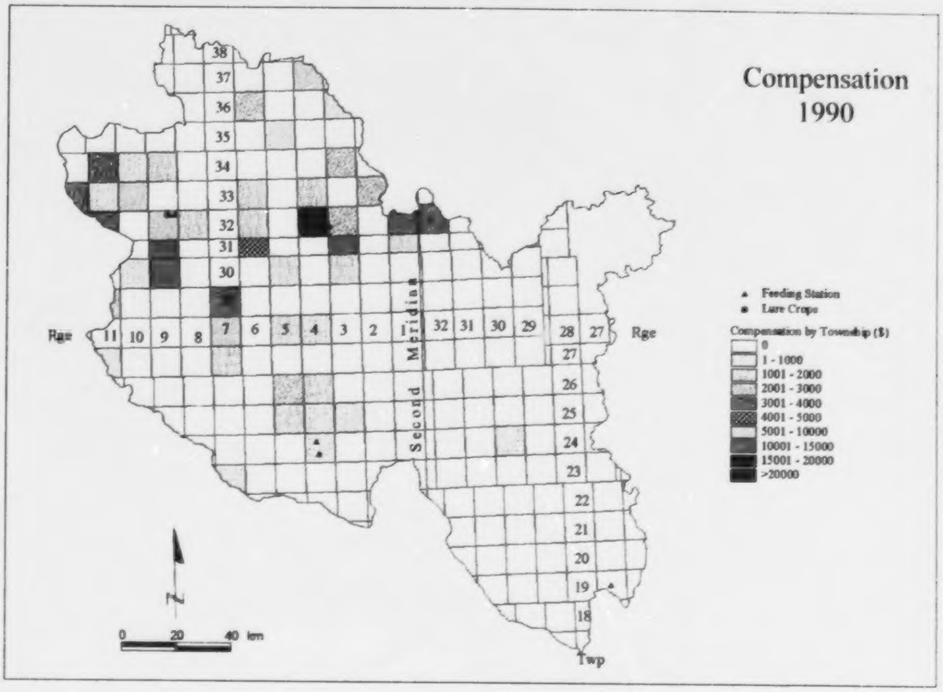
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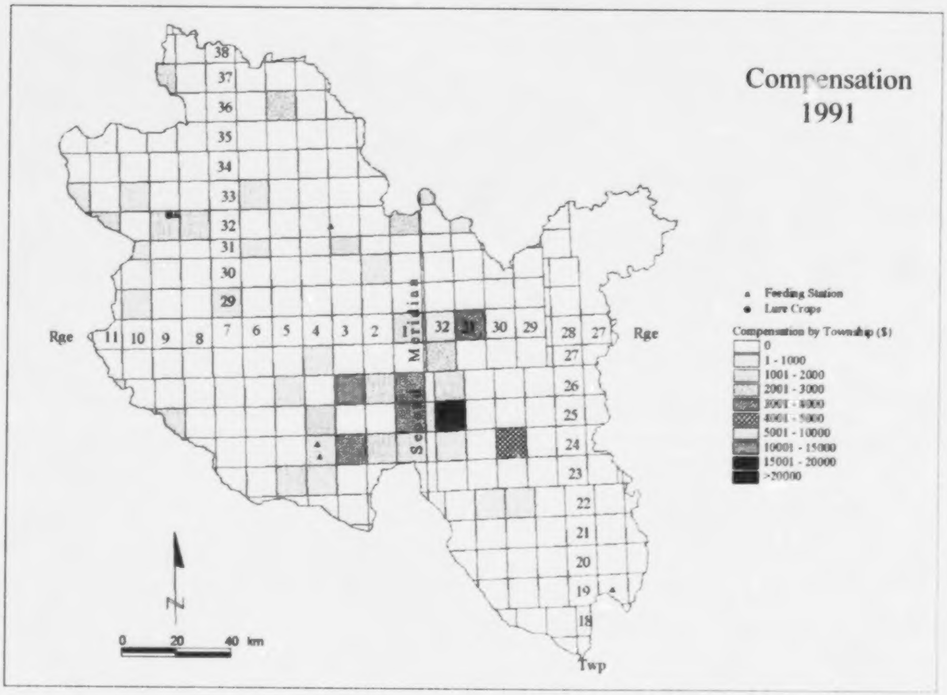
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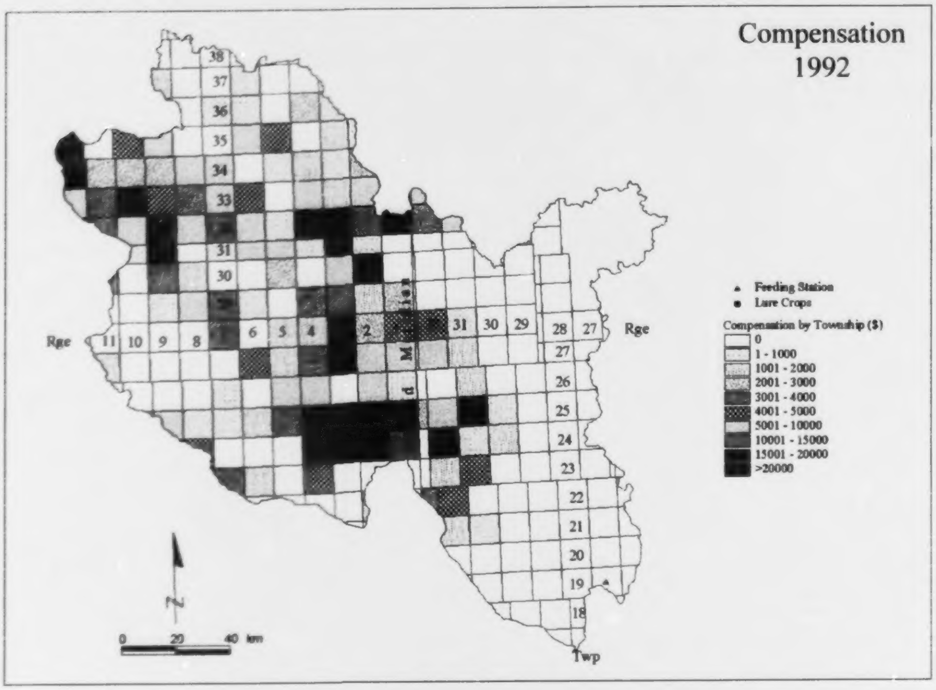
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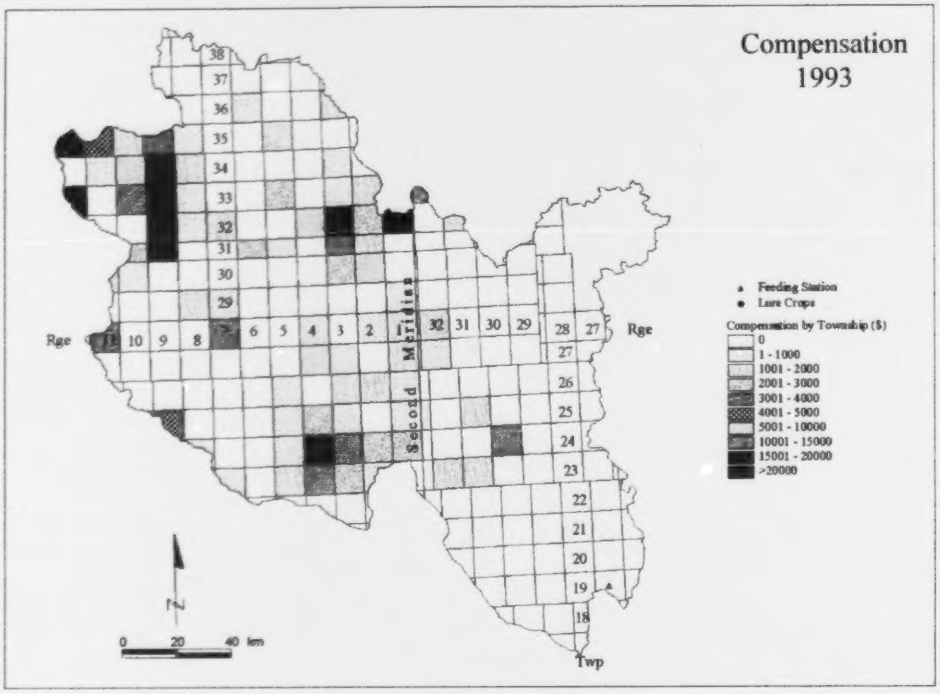
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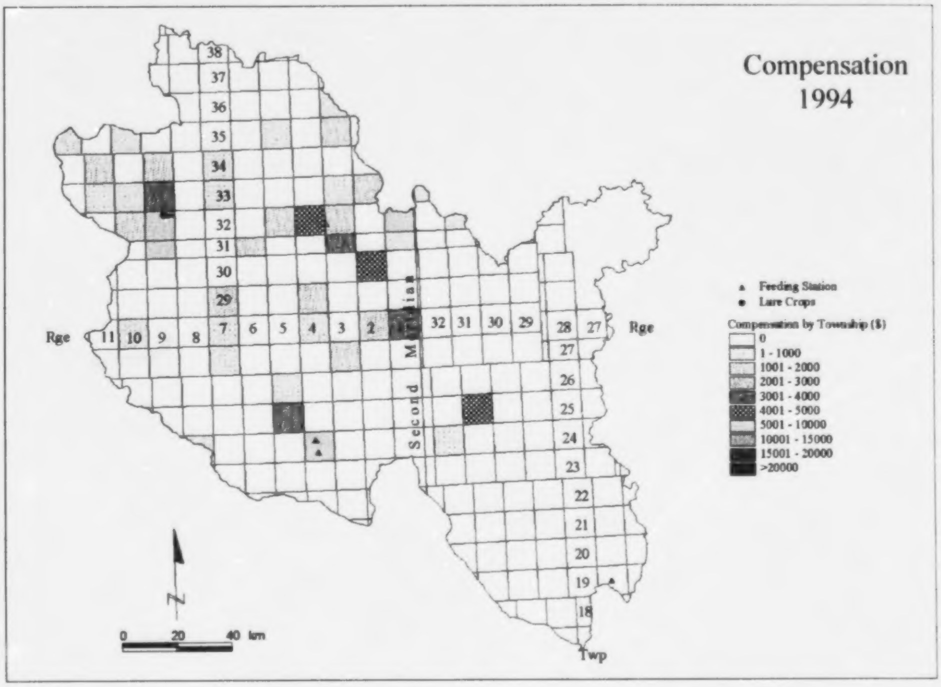
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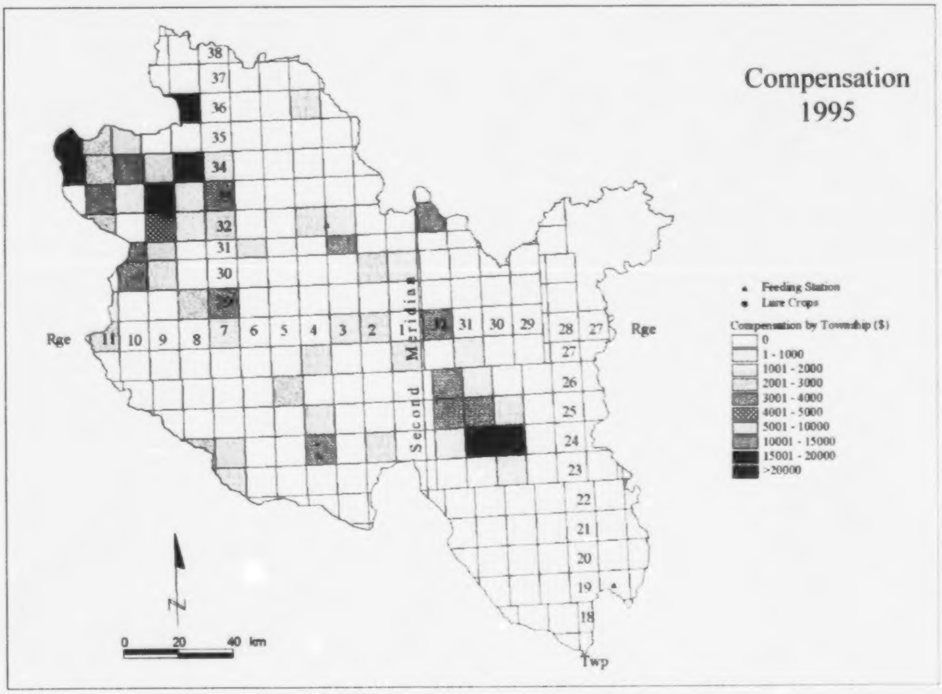
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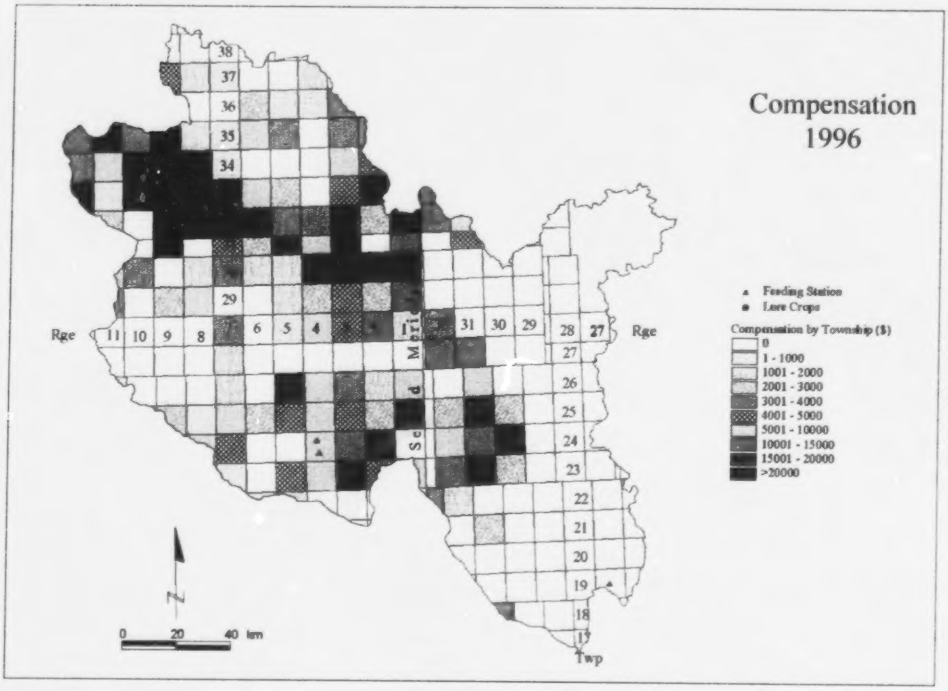
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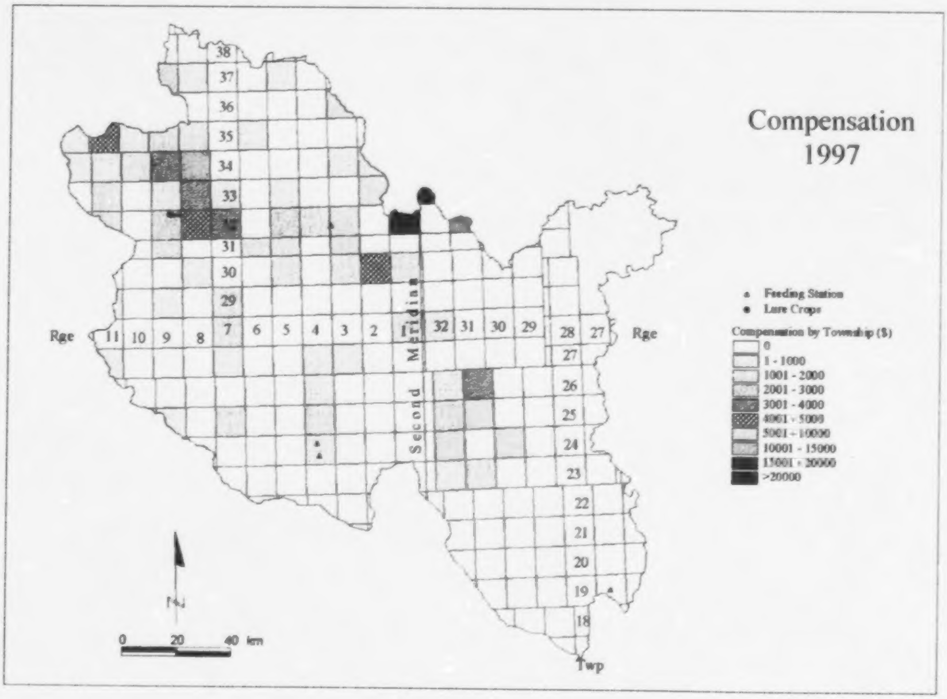
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Appendix V

Management of Wetland Resources

Management of Wetland Resources
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Appendix V

Management of Wetland Resources

1 Current Policies

Introduction

Government policies, programs and legislation influence land management practices and decisions. Their effects may be wide spread or narrowly focused, obvious or subtle. Nevertheless, policies potentially are very powerful mechanisms that manifest change on any landscape. Their outcomes are not always fully anticipated. Wetland and associated native upland habitats are regularly subjected to these influences as well. Local, provincial and federal levels of governments develop policies in response to perceived needs. Policies are not direct actions but rather are more global in nature. Therefore, policies are normally implemented through programs, by legislation or by changes in government procedures in regulating specific activities.

"It is a common view that policy is an inferior government tool because it does not have the same "legal teeth" as do statutes. In fact, public policy can call into service a range of legal tools to tackle a particular issue. It can guide the development, revision and interpretation of legislation. Policy can establish goals and objectives to work towards, and justify the resources that are required to make progress on issues. Policy calls attention to issues, and can promote awareness and understanding of issues among Canadians" (Lynch-Stewart *et al.* 1999).

1.1 Federal Wetland Policy

Wetlands in Canada are generally under provincial authority except where they lie on federal lands. The Federal Wetland Conservation Policy (Government of Canada 1991) is a shared federal responsibility and directs all federal departments to sustain wetland functions in the delivery of their programs, services and expenditures and all federal departments are responsible for implementing and financing its seven strategies . While there is no comprehensive statute in any jurisdiction in Canada that focuses exclusively on wetlands, the federal authority lies in its responsibility for maintaining the quality of the environment, migratory bird populations, inland and ocean fisheries and international or transboundary resources such as water and wildlife, reflecting seven federal statutes contributing, in part, to wetland conservation.

The Federal Policy on Wetland Conservation in Canada articulates the objective of the Federal Government with respect to wetland conservation: to promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions.

The Federal Policy commits the Federal Government, in cooperation with the provinces and the public to strive to achieve a series of seven goals:

- Maintenance of the functions and values derived form wetlands throughout Canada.
- No net loss of wetland functions on all federal lands and waters.
- Enhancement and rehabilitation of wetlands in areas where the continuing loss or degradation of wetlands or their functions have reached critical levels.
- Recognition of wetland functions in resource planning, management and economic decision-making with regard to al federal programs, policies and activities.
- Securement of wetlands of significance to Canadians.
- Recognition of sound, sustainable management practices in sectors such as forestry and agriculture that make a positive contribution to wetlands conservation while also achieving wise use of wetland resources.
- Utilization of wetlands in a manner that enhances prospects for their sustained and productive use by future generations.

In pursuing the above objectives the Federal Government respects nine principles:

- Wetlands and their functions contribute significantly to the health and well-being of Canadians and are a desirable element of Canada's natural diversity; as such, they are a priority requirement of environmental conservation and sustainable development efforts.
- Wetland conservation is dependent on the incorporation of environmental objectives into the economic decision-making process, as recommended by the (Bruntland) World Commission on Environment and Development, the Canadian Council of Resource and Environment Ministers (CCREM) National Task Force on Environment and Economy, the Federal-Provincial Agriculture Committee on Environmental Sustainability, and the Sustaining Wetlands Forum.
- Wetlands and wetland functions are inextricably linked to their surroundings, particularly aquatic ecosystems, and therefore, wetland conservation must be pursued in the context of an integrated systems approach to environmental conservation and sustainable development.
- Wetland conservation can only be achieved through a coordinated, cooperative approach involving all levels of government and the public, including landowners, non-government organizations, and the private sector.

- The Federal Government will play a major role in advocating and achieving wetland conservation, while respecting the jurisdiction of the provinces and territories and the rights of individual landowners.

- A basic change in the attitude and perceptions of Canadians regarding wetlands, through communication and education programs, is a vital prerequisite of wetland conservation.

- Canada has a special responsibility to provide leadership in international wetland conservation efforts, through the management of transboundary resources such as water and wildlife in North America, encouragement of global wetland conservation, and active participation in international treaties, conventions and forums.

The Federal Policy on Wetland Conservation outlines seven strategies to provide for the use and management of wetlands so that they can continue to provide a broad range of functions on a sustainable basis. These strategies are aimed at working in concert with other ongoing initiatives for wetland conservation. They are aimed at providing practical direction, support, and tools to program managers. They set out direction to put the federal house in order, to manage federal wetlands, and to ensure effective wetlands science and public awareness actions both nationally and internationally. The following seven strategies are deemed to be critical to the success of the Policy:

- Developing public awareness
- Managing wetlands on Federal lands and waters and in other federal programs.
- Promoting wetland conservation in federal protected areas.
- Enhancing cooperation.
- Conserving wetlands of significance to Canadians.
- Ensuring a sound scientific basis for policy.
- Promoting international actions.

The key commitment of the Federal Policy of Wetland Conservation with respect to the Upper Assiniboine River Basin lies in the goal for enhancement and rehabilitation of wetlands in areas were the continuing loss or degradation of wetlands has reached critical levels.

1.2 Saskatchewan

1.2.1 Saskatchewan Wetland Policy

In 1990 a Soil, Water, Wetlands Task Force Report recommended the development of a provincial wetland management policy. In 1991 the Saskatchewan Round Table on Environment and Economy identified the protection of wetlands and water resources as an environmental priority. In response to this need a working group with representation from relevant government agencies was directed to develop a wetland policy. Through extensive public, interdepartmental, and interagency consultation led by the Saskatchewan Wetland Conservation Corporation a wetland policy was developed. Cabinet approved the policy and objectives in March, 1995.

The wetland policy promotes wetland benefits and helps ensure a consistent provincial approach to land use policies and programs that impact wetlands. The wetland policy is a statement of principles and objectives requiring voluntary interest and compliance. It is not a regulatory document or law.

The wetland policy is the Province of Saskatchewan's commitment to wetland conservation and is a component of a provincial water strategy.

Objectives:

- To encourage sustainable management of wetlands on public and private lands to maintain their functions and benefits.
- To conserve wetlands that are essential to maintain critical wetland species or wetland functions.
- To restore or rehabilitate degraded wetland ecosystems where previous destruction or alternation has resulted in a significant loss of wetland functions or benefits

Principles:

- Wetlands are a valuable resource with multiple benefits.
- The rights of landowners and their role in the stewardship of land are recognized and their ongoing involvement is assured.
- The interest of aboriginal people in resource management will be respected and their involvement is assured.
- Wetland conservation will be pursued in an integrated approach to land use planning and management.
- Sustainable uses of wetlands are to be achieved through partnerships and co-operation with all levels of government and the public. The public will continue to be informed and involved in wetland management decisions through activities such as education and awareness programs and public consultations.
- All government organizations involved with or affecting wetlands are to recognize and consider wetlands functions in their policy and program development and decision making.
- Wetlands are an intrinsic component of broad ecological processes and systems.

Implementation:

Provincial government departments and agencies that participated in policy development and deliver land and water use programs and policies will continue to guide policy implementation. These include Saskatchewan Wetland Conservation Corporation (lead in policy implementation), Saskatchewan Environment and Resource Management, Sask Water, Saskatchewan Agriculture and Food, and Saskatchewan Municipal Affairs, Culture and Housing.

Policy implementation focuses on five key objectives:

- Increase awareness of the benefits of wetlands.
- Increase wetland monitoring.
- Co-ordinate government policies and programs to improve wetland management.
- Develop land use planning guidelines for wetland management.
- Encourage landowners to maintain wetlands.

1.2.2 Saskatchewan Water Management Framework

In 1994, the provincial government initiated a process to develop a provincial water management strategy. A discussion paper, Water Management: Issues and Challenges (Saskatchewan 1998), was developed by a working group that represented several government agencies. Following public review the working group prepared the Water Management Framework which was adopted by government in January 1999 (Saskatchewan 1999). This framework contains six water management principles and nine goals, presents 16 water management objectives and provides 58 actions to achieve these goals. Several of these objectives and actions directly relate to the management of wetland resources.

Objective 1: Maintain, restore and protect the health of aquatic and riparian ecosystems and drinking water resources.

Action 1: Develop indicators and monitor the health of drinking water sources and aquatic ecosystems.

Action 2: Establish criteria on aquatic ecosystem integrity which can be used to meaningfully guide economic activities.

Action 3: License works that modify flows in streams, giving due consideration to in stream use.

Action 4: Ensure that aquatic ecosystems and riparian areas are considered in the Representative Areas Network.

Action 6. Develop, policy for conserving riparian habitat on a watershed basis.

Objective 2: Minimize contamination of waterbodies.

Action 8. Promote more buffer strips and environmental reserves for activities such as forestry, mining and agriculture.

Action 9. Carry out additional field work research and monitoring on the effects of pesticide, nutrient and sediment impacts, and develop strategies to reduce impacts.

Action 10. Develop and disseminate best management practice guidelines for livestock access to shorelines.

Objective 4: Foster wetlands retention and orderly drainage, in accordance with regulations and public policy.

Action 15. Pursue public and private economic incentives to encourage wetland retention by landowners.

Action 16. Establish interdepartmental Task Force to undertake public consultation, build on the findings of UARBS and make specific recommendations to Cabinet on government's role in protecting wetlands and developing a new drainage policy.

Action 17. Develop and implement a wetlands conservation plan, consistent with Saskatchewan's Wetland Policy, following development of a wetlands inventory and monitoring program, prioritization, and development of a new drainage policy.

Action 18: Develop inter agency enforcement strategy and change legislation to more effectively deal with unauthorized drainage.

Action 20: Explore feasibility of introducing a conservation assessment on drainage to mitigate impacts and to develop and enhance wetlands.

Objective 12: Manage water on a watershed basis.

Action 42: Assess options to provide local watershed management by consulting with stakeholders and reviewing existing legislation.

Action 44: Actively involve local authorities in a broad watershed approach to address local watershed management issues.

Objective 15: Enhance public awareness and involvement in water management planning and decision making.

Action 54: Encourage development of volunteer monitoring activities such as lake stewardship/co-management programs.

Objective 16: Recognize the intrinsic and economic value of water and cost of its management.

Action 57: Develop long-term communication plans to increase public awareness and understanding of water management and the value and importance of water.

Seven of the 16 Water Management Framework objectives and 17 of the 58 action items pertain to maintaining wetlands.

1.3 Manitoba

1.3.1 Manitoba Water Policies

In 1989, as part of its mission to achieve sustainable development, the Government of Manitoba began preparation of a strategy that would comprehensively address management and development of land and water resources. Water was the first resource to be addressed since its management affects all other resources and the environment. The provincial government subsequently developed, with extensive stakeholder and public participation and support, a set of new water policies. The water policies were structured in seven policy areas: water quality, conservation, use and allocation, water supply, flooding, drainage, and education. The policies were approved in March, 1990.

The policies which apply to wetlands fall under the following areas:

Objective 1: Water Quality: To protect and enhance our aquatic ecosystems by ensuring that surface water and groundwater quality is adequate for all designated uses and ecosystem needs.

Policy 1.1: The "Manitoba Surface Water Quality Objectives" shall be adopted and implemented to protect water uses for Manitobans.

Policy 1.4: The quality of waste water discharges shall be improved and non-point sources of pollution decreased to achieve water quality objectives.

Objective 2: Conservation: The objective is to conserve and manage the lakes and rivers, and wetlands of Manitoba so as to protect the ability of the environment, to sustain life and provide environmental, economic and aesthetic benefits to existing and future generations.

Policy 2.1: River, lake and shoreland habitat and the general environmental, subsistence, and economic values of rivers, lakes, and wetlands shall, where possible, be conserved.

Policy 2.2: Soil conservation, wetland retention, and the application of appropriate land use practices shall be promoted primarily by the provision of incentives, but with regulation where required, not only as essential elements of water conservation and protection, but also as key measures to reduce siltation impacts, downstream flooding, and non-point source pollution.

Policy 2.4: Water retention, and control and timing of runoff, shall be promoted as part of watershed management.

Objective 3: Use and Allocation: To ensure the long term sustainability of the province's surface water and groundwater for the benefit of Manitobans.

Policy 3.1: Economic well being and sustainability shall be the goal in the allocation and utilization of Manitoba's water resources for consumptive and instream uses.

Policy 3.2: Water management priorities shall be determined through a basin planning process that takes into account the protection of potable water supplies, environmental integrity, existing commitments, and economic requirements.

Objective 6: Drainage: The objective is to enhance the economic viability of Manitoba's agricultural community through the provision of a comprehensively planned drainage infrastructure.

Policy 6.2: The standard of drainage shall be based on the production capability of the soil criteria, recognizing watershed, community and farm impacts.

Policy 6.6: The protection of wetlands shall be a consideration in planning and developing drainage projects.

Policy 6.7: Water retention, and control and timing of runoff, shall be promoted as part of watershed management.

Implementation:

In March 1994, the Minister of Natural Resources released a document entitled Sustainable Development – Applying Manitoba's Water Policies (Manitoba no date). It was prepared with input from a number of government departments including Natural Resources, Environment, Agriculture, Rural Development, Urban Affairs and others. As the document notes, the application of Manitoba's water policies will involve not only provincial and federal government departments but all other stakeholders, including local governments, conservation districts, industry, developers, business, local associations, institutions, and private citizens. These policies will be applied in all phases of water management from planning to decision making.

1.3.2 Manitoba Land Drainage Review

New opportunities and challenges face agriculture in Manitoba today necessitating an efficient and coordinated drainage system. The inability of the Province and the municipalities to maintain existing drainage systems, changing cropping and land use, a dramatic increase in the capacity of producers to undertake on farm drainage, have combined to manifest a whole new set of problems associated with unauthorized drainage, landowner conflicts, increased crop damage, and jurisdictional disputes. A sustainable approach to drainage requires full cost accounting in addressing all of the benefits and costs of drainage.

A Land Drainage Review Task Force held 11 open houses across Manitoba's agricultural region between November1997, and February 1998. Over 700 people attended the open houses and provided comments, concerns, and suggestions. At the open houses sixteen issues, identified by the Land Drainage Review Task Force, were reviewed by the public. The top seven issues identified were:

- maintenance of the existing system
- defined responsibility
- downstream impacts
- local involvement
- the watershed approach
- drainage system upgrading and
- drainage works that make good economic sense.

Overall, forty percent of all respondents indicated that the key issue in their area was the need for some type of drainage work and about forty percent also indicated that the other key issue was the impact of drainage works on downstream producers. The document Land Drainage Review: Summary and Recommendations (Manitoba Natural Resources 1998) was distributed which compiled the issues and suggestions.

It was recognized that drainage problems did not develop overnight. Also, no single program or initiative is the quick, all encompassing, solution. A long term commitment to address problems in a number of ways was seen as the answer. Options have been identified to address the following areas:

- Watershed Based Management: The Conservation District approach is the only tested approach to integrated water management in Manitoba. Water is to managed on a watershed basis.

- Drainage Maintenance and Reconstruction: It was proposed that a consultant be used to determine what portion of the benefits accrue to the producer, the municipality, the province or the federal government and to determine the differences across the province. Expenditures for maintenance are to be prioritized to favor waterways where municipalities are coordinating their works on a watershed basis and have a plan in place.

- Expansion of the Drainage System: Limited funds have resulted in few opportunities for new works. There is no provision for a petitioning process by landowners to have the opportunity to drain. Modifications to *The Conservation District Act* or *The Municipal Act* are required to allow for petitioning within the context of watershed management .
- Drainage Licencing: The licensing process does not address cumulative impacts. Ideally, if watershed planning groups prepared an approved drainage plan for their watershed, drainage works consistent with the plan would be automatically approved. Guidelines for licensing will be required on a watershed basis.
- Enforcement: Manitoba Natural Resources should continue to have the responsibility for enforcing *The Water Rights Act* and the Natural Resource Officers should be continued to be used for enforcement.
- Awareness and Training: There is a need to provide groups with appropriate information on drainage standards and procedures and to provide training to those involved.
- Wetland Protection: Wetland and fish habitat protection is to be addressed in the planning process.
- Inter-provincial and International Watersheds: Permanent watershed boards should be established to provide a mechanism for avoiding and resolving transboundary disputes.
- Fish and Fish Habitat Protection: Fish habitat is to be considered in the planning and design process of drainage works. A fisheries biologist would be part of the process.
- Basin Boards: Conservation Districts and Watershed boards need to coordinate activities at the basin level to ensure the cumulative affects of drainage are considered.
- Interdepartmental Coordination: Formation of an interdepartmental committee represented by Highways and Transportation, Natural Resources, Agriculture, Environment, and Rural Development is needed to coordinate the provincial role in drainage.
- Beavers: The Department of Natural Resources is to work with the Municipalities and Conservation Districts to make the program more effective.
- Legislation: Legislative changes must accommodate Drainage Plans or Water Management Plans prepared by Conservation Districts, watershed groups, or municipalities. *The Municipal Act* needs to be revised to include responsibility and authority for drainage.

- Water storage and retention: Support from provincial and municipal governments (including legislative) should be provided to conservation districts and other watershed groups undertaking water storage and retention projects for wildlife and downstream drainage and flood control benefits.

Public review of the document and associated recommendations will form the basis of final recommendations to the Minister of Conservation and ultimately set the course for managing land drainage in Manitoba. Initiation of these options began in 1997.

2 Government Initiatives

2.1 Government of Canada

2.1.1 North American Waterfowl Management Plan (NAWMP)

The Government of Canada and the United States signed the North American Waterfowl Management Plan (NAWMP) in 1986. By restoring wetlands and associated ecosystems, the plan called for the recovery of waterfowl populations to 1970s levels. The vision was to conserve biological diversity in the western hemisphere and to integrate wildlife conservation with sustainable economic development. The Prairie Habitat Joint Venture encompassed the prairie pothole region of Alberta, Saskatchewan, and Manitoba. Within each province, stakeholders worked to identify a specific habitat plan to meet the plan's overall duck population goals

Saskatchewan's strategy called for a combination of land management with a change in attitudes and policies influencing land use. The approach was to encourage land use practices on private and crown land that would benefit waterfowl production and other wildlife species, by providing upland nesting cover. While the primary focus was on small wetlands and complexes, protection and management of larger wetlands, important to staging, molting and production were recommended. An overall 15 year budget of $438 million was proposed to affect 5.7 million acres

On behalf of the NAWMP partner organizations Ducks Unlimited Canada has delivered the Prairie Care Program since 1989. In seven key project areas, monetary and other incentives are available to landowners for participating in programs which preserve or improve wetlands and upland nesting cover. The wetland conservation program absorbed the existing Saskatchewan Heritage Marshes Program.

a) Saskatchewan implementation - Saskatchewan Wetland Conservation Corporation

In 1990 the Saskatchewan Wetland Conservation Corporation (SWCC) was created to coordinate the NAWMP in Saskatchewan to encourage sound land use practices for the benefit of people and wildlife. SWCC is responsible for evaluating biological success, co-ordinating communications, financial administration and and policy negotiations with other government agencies and private organizations. Board members represent Ducks Unlimited, SERM, Environment Canada (CWS), Sask Agriculture and Food, Saskatchewan Wildlife Federation, Saskatchewan Association of Rural Municipalities, Sask Water, Nature Saskatchewan, Saskatchewan Wheat Pool, along with members-at-large. With the creation of SWCC the Prairie Shores Program was announced in 1991. Specific attention was directed at wetland habitat providing both waterfowl and other wildlife benefits, including shorebirds. Critical shorebird habitat was identified and monitored. Land management projects secured key parcels and enhanced existing crown pastures. SWCC has lead policy and communication initiatives in coordinating overall NAWMP program administration. More recent undertakings are the Native Prairie Stewardship Program which is designed to encourage landowners, on a voluntary basis, to protect samples of native prairie in heavily and moderately cultivated areas through simple land management practices. The other is the Riparian Stewardship Program intended to increase awareness of the value of riparian habitat and effects of land use on this zone and to demonstrate ways to maintain and improve riparian habitat.

b) Manitoba implementation - Manitoba Heritage Corporation

The Manitoba Habitat Heritage Corporation (MHHC) is a Crown Corporation with the mandate to conserve, restore, and enhance fish and wildlife habitat in Manitoba. The Corporation focuses on private land in agricultural Manitoba and currently its efforts are concentrated in southwestern Manitoba extending from the U.S. border north to Riding Mountain National Park, through the Upper Assiniboine River Valley. The corporation has four field offices: Killarney, Reston, Minnedosa and Shoal Lake. Most of MHHC's activities in the Upper Assiniboine Basin are directed through the Shoal Lake office.

MHHC implements three main programs in this area: the Green Banks program, the Agro-Woodlot program, and the Green Acres program, MHHC's contribution to the North American Waterfowl Management Plan (NAWMP).

The Green Acres program offers various land securement options for conservation of wildlife or fish habitat in the area such as acquisition, donation, or leasing of ecologically significant land by MHHC. Other options include wetland creation and duck nesting tunnels. A new conservation tool now available to landowners is the conservation agreement. With conservation agreements, tracts of habitat specified by the landowner and conservation agency can be set aside for wildlife in perpetuity.

The Green Banks program's aim is to help fund and inform local cattle producers of new methods of rotational grazing and watering systems to increase calf yield and protect the riparian, or shoreland habitat along waterways. The riparian area is extremely important for the health of the waterbody as well as the wildlife that call this transition zone between water and land home. With a system to pump water from the river or lake to a holding tank within a rotational grazing system, the cattle benefit from the clean water and improved forage and the riparian zone and river remain healthy.

Activities in the Green Banks program include working directly with the producers to set up systems on their properties as well as work with the Agro-Woodlot Program to rehabilitate the riparian zone. One method of rehabilitation includes bio-engineering or the use of willow cuttings as "rebar" to stabilize the streambank and provide foliage and cover.

Extension and communication activities in the area include local media stories outlining MHHC's conservation role, as well as displays at local fairs highlighting MHHC's activities. The first in-depth grazing workshop was held in Shoal Lake to compliment tours MHHC has co-sponsored to view grazing systems in North Dakota.

MHHC's involvement in the Upper Assiniboine Basin region has been strong in recent years, and promises to increase in the future. MHHC is continually working to restore and protect the natural habitat in the Assiniboine River Valley through cooperation with local landowners and organizations interested in wildlife habitat conservation.

2.1.2 Prairie Farm Rehabilitation Administration (PFRA)

The Prairie Farm Rehabilitation Administration Act establishing PFRA is administered by Agriculture Canada and provides parliamentary authority to secure the rehabilitation of drought and soil drifting areas in the provinces of Manitoba, Saskatchewan, and Alberta, and to develop and promote within those areas systems of farm practice, tree culture, water supply, land utilization, and land settlement that will afford greater economic security through the development, construction, promotion, operation, and maintenance of any project or scheme, and enter into agreements with any province, municipality, or person.

From its beginnings, PFRA has delivered emergency and special-purpose programs on behalf of the federal government - more than 40 since 1970. These programs have been wide ranging. Some have dealt with emergency conditions caused by drought and floods. Others have been long term programs meant to improve conditions on the Prairies, by developing or improving municipal water and irrigation infrastructure, regrassing degraded crop land, improving the environmental impact of agriculture, and assisting rural entrepeneurs.

Land Management:
PFRA's land management expertise includes rangeland condition assessments and reclamation, wildlife and waterfowl habitat evaluation, riparian and wetland area management, rangeland vegetation management (i.e., control of exotic weeds and undesirable plants in rangeland) and forage selection, utilization and establishment. The Community Pasture Program helps producers strengthen their operations by providing a breeding service and summer pastures for livestock grazing, while preserving wildlife habitat and protecting marginal soils from erosion by maintaining a permanent cover.

PFRA delivers the National Soil and Water Conservation Program (NSWCP) in the prairie region. The NSWCP focuses on water and manure management, addressing water quality issues, particularly as they apply to the expansion of livestock operations. NSWCP supports projects and activities which promote environmental farm plans and other integrated resource management mechanisms.

PFRA monitors long term contracts under the Permanent Cover Program (PCP) and provide advice to clients regarding management and economic opportunities for this land. The PCP removes marginal lands from intensive crop production and puts it under annual forage cover. Environmental benefits of the PCP include increased soil conservation, associated improvements in water quality and enhanced wildlife habitat.

The Shelterbelt Centre provides tree and shrub materials for field and farm shelterbelts, riparian areas and woodlot planting. This program is another measure which helps reduce erosion and moisture losses and provide wildlife shelter and habitat.

Rural Water:
PFRA applies its expertise to secure supplies of water, good water quality and wastewater infrastructure on the Prairies. PFRA provides technical assistance in the planning, investigation and design of water supply projects, including wells, dugouts, springs and water quality enhancement projects. Assistance is also available for regional initiatives such as ground water exploration and mapping, community water conservation and supply projects, basin studies, water supply pipelines and other facilities.

Rural people often face constraints in developing or expanding businesses due to limitations in water quality and quantity. PFRA is adapting programs and expertise to overcome these constraints. For example, The Sustainable Water Well Initiative was undertaken to improve existing water wells by providing advice on the diagnosis, prevetion, and rehabilitation of well problems. Recent changes include providing assistance on projects that improve water quality. Also recently introduced is the Small Water Development Project program which is a partnership with Ducks Unlimited that provides funding to rural clients to develop small-scale water projects in the Grassland eco-region of Saskatchewan. These water and wetland developments provide both agricultural and environmental benefits for waterfowl and other wildlife species.

Resource Conservation:
PFRA's approach to resource conservation integrates land management and water resource management through the provision of technical assistance on conservation practices, crop productivity management, sustainable grazing systems, cattle production, resource management planning and adoption of sustainable land uses.

Innovative irrigated crop production practices and technologies are studied and demonstrated through the Saskatchewan Irrigation Diversification Centre and Manitoba Crop Diversification Centre and through joint initiatives with partners.

Resource monitoring, through the use of GIS technology and the Drought Watch network, is used to identify and implement resource conservation activities in the area of greatest need. Databases are being developed for land capability and utilization information that support the production of forage and specialty crops, increased grazing potential and intensified agricultural operations.

PFRA is currently assessing the state of Prairie land resources and their capacity to support present and future agricultural production and value-added processing. Prairie Agricultural Landscapes (PAL) is a new initiative which will examine the emerging environmental issues, geographic distribution of different farming systems, economic and resource data.

PFRA cooperates with a number of agencies and groups, such as Canadian Wildlife Service and research stations, universities and non-government organizations in caring for the prairies landscape.

PFRA is the lead agency for developing the Wildlife Habitat Indicator, part of a national set of Agri-Environmental Indicators designed to provide a profile of the state of Canada's environment and to measure progress towards sustainable development. This project will integrate wildlife species and land use information and enhance current information on the uses various wildlife species make of agricultural land. This indicator will be used to predict risk to biodiversity and to aid in habitat planning and development.

Rural Growth:
PFRA helps prairie clients to plan, design, and implement sustainable development strategies in rural areas. PFRA works with partners and clients to identify, develop and demonstrate diversification opportunities, resource management practices, and innovative cost saving technologies, which complement the work of research organizations. Various Federal-Provincial agreements such as Canada-Saskatchewan Agri-Food Innovation Agreement (AFIF) focus on developing opportunities in emerging areas with a potential for growth- horticulture, special crops, specialized livestock, food processing, non-food processing, biotechnology, sustainable agriculture and information technology. The CARD Funds in Saskatchewan (CARDS) is targeted at projects that will help develop a strong, vibrant agricultural and rural economy.

PFRA assists local groups, communities, sector and rural organizations to identify opportunities and means of removing constraints related to land and water resources for economic initiatives. PFRA's participation in water supply and wastewater treatment projects allows the expansion of existing operations and the establishment of processing industries in rural communities. Infrastructure improvements are pursued through The Canada Agri-Infrastructure Program (CAIP) and the Rural Water Development Program.

2.1.3 Statutes That Contribute to Wetland Conservation

- The Migratory Birds Convention Act

The *Migratory Birds Convention Act* implements an international treaty signed in 1916 by the United States and the United Kingdom on behalf of Canada. The Act focuses on the protection of migratory birds by regulating the hunting, possession, transportation and sale of migratory birds and the disturbance of their nests. The Act authorizes the establishment of protection areas for migratory birds called Migratory Bird Sanctuaries and the control and management of those areas. To be designated, a site must contain nationally significant habitat for migratory birds, regularly supporting at least one percent of a population of migratory bird species or subspecies.

Designation also requires the consent of the public or private landowner. A site is officially scheduled under the Migratory Bird Sanctuary Regulations, which prohibit all disturbance, hunting, and collection of migratory birds and their eggs within the MBS. Contravention of the Act can result in fines of up to $250,000 and a court order for compensation for remedial actions. The Act focuses on birds and nests, however, does not provide for conservation of the habitat that sustains the birds through their life cycle.

- The Canada Wildlife Act

The *Canada Wildlife Act* enables the Minister of Environment to undertake programs for wildlife research, conservation and interpretation, and to coordinate and implement wildlife policies and programs in cooperation with provincial and territorial governments. Under the Act, wildlife includes any animal, plant or other organism belonging to a wild species and also the habitat of any wild animal, plant, or organism.

Authority rests under the Act for the establishment of National Wildlife Areas. Protected areas designations under the Act can apply to internal waters, and therefore can be used to protect freshwater wetlands associated with inland lakes and rivers. In Canada there are currently 45 National Wildlife Areas protecting 287,000 ha. of habitat, with another six sites awaiting designation. The Act also provides the authority for the establishment of advisory bodies reporting to the Minister of Environment. In 1990, The North American Wetlands Conservation Council was created under this authority. The council coordinates the implementation of the North American Waterfowl Management Plan in Canada, and promotes wetland conservation through coordinating management, science and policy initiatives.

- The National Parks Act

The *National Parks Act* empowers the Minister of Canadian Heritage to acquire and manage lands as National Parks of Canada, to “be maintained and made use of so as to leave them unimpaired for the enjoyment of future generations”. Wetlands in National Parks have strong legal protection owing to the “unimpaired” clause in the Act and the 1988 amendment to the Act that requires that “maintenance of ecological integrity through the protection of natural resources shall be the first priority when considering park zoning and visitor use in a management plan”. Industrial development is not specifically prohibited, but regulations generally prohibit logging, mining, and hunting within National Parks

- The Fisheries Act

The *Fisheries Act* sets out the means by which the Minister of Fisheries and Oceans manages and protects fisheries and fish habitat. The Act applies to all Canadian Fishery Waters, and has provision for pollution prevention, conservation, and protection of fish habitat. The Act provides for penalties ranging from fines to imprisonment, or restoration orders. Federal responsibility for inland fisheries management have been delegated to some provinces, however the federal government remains responsible for fish habitat management throughout Canada.

The Policy for the Management of Fish Habitat (1986) was developed to guide implementation of the habitat conservation and protection provisions of the *Fisheries Act*. The Policy, together with associated guidelines and decision frameworks, has provided a more structured approach to fish habitat conservation. The Policy's No-Net-Loss Principle contributes significantly to habitat conservation. Because wetlands can provide "fish habitat" as defined by the Act, recent reviews of statutes and their relationship to biodiversity or wetland conservation regard the *Fisheries Act* as a potent tool against activities that threaten or impair wetlands

To some degree wetlands are considered part of fish habitat according to the Act. The Canadian Department of Fisheries and Oceans (DFO) is increasingly becoming involved in the environmental assessment of proposed projects primarily through the provincial environmental review processes. This involvement is administrative as opposed to a prescribed process under the *Fisheries Act*. For development that will harm, disturb, or destroy habitat DFO negotiates a binding agreement that specifies the amount, type, timing, and location of work along with any monitoring requirements. The agreements may also incorporate provincial needs.

- INCOME TAX ACT OF CANADA

In 1995, the Minister of Finance announced a new initiative under the *Income Tax Act of Canada*, creating provisions for donation of ecological gifts. Donation by private individual and corporate landowners of "ecologically sensitive land" is emerging as a new tool in conserving wetlands and other ecosystems across Canada.

Ecological gifts include the donation of fee simple title for ecologically sensitive lands and environmental conservation covenants, easements and servitudes as permitted under provincial or territorial legislation. The provisions of the Act are specific to donations of land that are under private title, thus excluding donation of leased rights or use of Crown held properties. An ecological gift must satisfy the same criteria for all other philanthropic donations established by Revenue Canada in order to qualify for preferred tax treatment. Such donations may be deducted against up to 100 percent of annual income and the unused portion of a receipt may be carried forward for up to five years.

The *Income Tax Act* allows ecological gifts to be received by qualified environmental charities, any Canadian municipality and any federal, territorial, or provincial Crown agency. A wide range of representative, unusual, rare or threatened habitats have been donated to date. These comprise numerous wetlands including salt marshes on both the Pacific and Atlantic coasts, riverine wetlands, prairie sloughs, and temperate freshwater marshes and swamps.

- ENVIRONMENTAL ASSESSMENT ACT

The *Environmental Assessment Act* is a tool for federal decision makers. It establishes an open and balanced process to assess the environmental effects of projects requiring federal action or decisions. It ensures that the environmental effects of projects are considered as early as possible in a projects's planning stages. The Act is administered by the Canadian Environmental Assessment Agency (CEAA). It reports directly to the Minister of Environment and operates independently of any other federal department or agency.

An environmental assessment is required if a federal authority exercises one or more of the following duties, powers, or functions in relation to a project:
. Proposes the project.
. Contributes any other form of financial assistance to the project.
. Sells, leases, or transfers control of administration of land to carry out the project.
. Exercises a regulatory duty in relation to a project that is included in the Act's Law List regulation.

A 'Project" is defined as either:
. An undertaking in relation to a physical work, such as any proposed construction, operation, modification, decommissioning, or abandonment; or
. Any physical activity not relating to a physical work that is listed in the Inclusion List regulation under the Act.

Under the Act, the extent of environmental assessment a project receives depends on the scale and complexity of the likely effects of the project. There are four types of environmental assessments.
. Screening - It is a systematic approach to documenting the environmental effects of a proposed project and determining the need to eliminate or minimize these effects; to modify the project plan;.or recommend further assessment through mediation or panel review.
. Comprehensive study - Projects that have potential to create significant adverse effects and generate public concern undergo a more intensive detailed assessment.
. Mediation - A voluntary process of negotiation in which an independent impartial mediator appointed by the Minister of Environment helps the parties resolve issues and reach consensus.
. Panel review - Where mediation is not appropriate, or fails, the environmental assessment is conducted by an independent public review panel appointed by the Minister of Environment. The panel makes recommendations to the government at conclusion of the public review process.

Public involvement is a key objective of the Act. Through public participation activities project proponents can better understand and respond to public concerns and inform people about decisions. Public concerns can also trigger the need for a review by a mediator or panel.

The Act allows the Minister to enter into bilateral agreements with other provinces and territorial governments relating to environmental assessment of projects where both governments are being asked to provide licence, permit, certificate, or authorization. These agreements avert unnecessary duplication, confusion, and excessive costs for all parties.

2.2 Saskatchewan

2.2.1 Sask Water

Sask Water, a Crown Corporation, is Saskatchewan's water manager mandated to:

- Manage, administer, develop, control, and protect the water and related land resources of Saskatchewan.
- Promote the economical and efficient use, distribution, and conservation of water.
- Maintain and enhance the quality and availability of water for domestic, agricultural, recreational, and other purposes.

Sask Water develops management plans for surface water on a watershed basis and for groundwater on an aquifer basis. These management plans help ensure the water resources and ecosystems that depend on them are protected. Sask Water considers all interests in water in the basin planning process. Thus, areas requiring special attention can be identified and protected.

All types of water projects (excluding rural domestic) require Sask Water approval. Approvals are also necessary for all municipal water treatment, distribution, and effluent treatment systems. Sask Water also reviews all Environmental Impact Statements submitted to government for potential impacts on the province's water resources. Sask Water chairs the Wetland Technical Advisory Committee which works with other government agencies to review and identify effects on wetlands of flood control and water development project proposals submitted by local governments (seeking government financial assistance), and Ducks Unlimited.

Corporate commitment to wetland protection - Sask Water has maintained a strategy for addressing wetland sustainability since the establishment of the Corporation. In the fall of 1992 Sask Water adopted a position to provide the public and Corporation staff with a clear definition of wetlands and the need to ensure their sustainability. Three classes of wetlands were defined and assigned a ranking value to each. Wetland maintenance would be supported by:

- Focusing financial assistance under any water development policy in a manner that encourages the maintenance of wetlands.
- Focusing regulatory efforts in the area of drainage control, water management, and land use in such a manner that assists in retention of wetlands.
- Promoting education and understanding about the value of wetlands including the value of biodiversity which they support.

Sask Water actively participated in the provincial working group charged with developing a provincial Wetland Policy and in the policy implementation committee subsequent to government approval of the policy in 1995. Sask Water has the regulatory responsibility to approve or deny approval of works. Sask Water is incorporating the objectives of the Wetland Policy into planning processes, lines of business and policy.

2.2.2 Saskatchewan Environment And Resource Management

Saskatchewan Environment and Resource Management's (SERM) mandate is to manage, enhance and protect Saskatchewan's natural and environmental resources - fish, wildlife, lands, forests, parks and protected areas, air, water and soil - for conservation, recreation, social, and economic purposes and to ensure they are sustained for future generations. This includes:

- Protection of the primary resources using regulatory and non-regulatory controls.
- Management and protection of natural resources to insure their sustainability and biological activity.
- Implementation of the environmental impact assessment program.
- Utilization of the natural resources while maintaining resource sustainability.
- Promotion of public, stakeholder and aboriginal peoples' involvement in environmental and resource management.
- Promotion of stewardship of the environment.
- Cooperation in the development of initiatives aimed at enhancing the environment.

SERM, in fulfilling its mandate, has adopted eight 'Strategic Principles': Public involvement, Integration, Ecosystem approach, Sustainability, Empowerment, Harmonization, Equity, and Root causes. The foundation of SERM's new vision is the application of Ecosystem Management. In January 1999, SERM initiated a strategic plan called *"Ecosystem Management Plan of Action for Saskatchewan Environment and Resource Management."*

Ecosystem management is understood to be monitoring and managing activities, including human activities, with the intent to maintain the health and integrity of ecosystems. SERM defines ecosystem management as a philosophy of collaborative land management that has a general goal of protecting native ecosystem integrity over the long term. The strategic plan is organized into eight broad categories:

- Biodiversity and Ecological Integrity
- Water/Aquatic Ecosystems
- Ecological Framework
- Ecosystem-based Planning and Implementation
- Research and Monitoring
- Integration and Communication
- Economic Development
- Aboriginal Affairs

Management success will be evaluated by comparing managed areas to benchmark areas, which are maintained as free of human intervention to the highest degree possible. SERM has divided the province into five ecoregions for administrative purposes. Planning begins at the ecoregion level, using an ecosystem-based approach. Provincial polices, goals and objectives are applied within the context of specific ecoregions. Local issues and expertise are then incorporated with provincial direction to create an ecoregion plan that is sensitive to the specific ecological and social conditions of the ecoregion.

SERM has identified wetlands and riparian habitats as vital components of its management goals. Water is a fundamental component of an ecosystem. Aquatic ecosystems can be viewed as individual ecosystems or as a part of larger terrestrial landscapes. As a result, the management of water and aquatic ecosystems is complex. SERM supports an ecosystem-based approach to water and aquatic habitat management and is reviewing and updating current management processes and guidelines.

In an earlier section of this appendix, the Saskatchewan Water Management Framework was described. This framework contains six water management principles and nine goals, presents 16 water management objectives and provides 58 actions to achieve these goals. SERM is the lead agency in delivering 13 of the 58 action items and jointly on 4 additional items. Six of these actions pertain directly to wetland and riparian habitats.

SERM participated in the development of the Saskatchewan Wetland Policy and are implementing the objectives of this policy.

2.2.3 Saskatchewan Wetlands Committee

In the early 1970s, a growing concern over the loss of wetlands and waterfowl habitat through government subsidized drainage and flood control programs caused government to respond and act with a policy to resolve conflicts between various interests in resource management as related to wetlands. In 1971 Cabinet established the Saskatchewan Wetlands Committee to resolve agricultural-wildlife conflicts rising from wetland drainage projects and development of wetlands for other purposes (i.e. Ducks Unlimited). The Parent Committee consisted of the deputies of the departments of Agriculture, Natural Resources, and Environment. The Parent Committee established the Technical Advisory Committee (TAC) to assist them. All projects are scrutinized by the TAC. Those which cannot be resolved are referred to the Parent Committee. When Sask Water was established in 1984, it assumed the chairmanship of both committees. In 1994, the Wetlands Conservation Corporation became a member of the TAC.

The TAC has had a quasi-regulatory role in reviewing project proposals and participating in resolution of conflicts. The TAC was mandated to review projects associated with Sask Water's Water Control Assistance Program (Rural and Urban flood control, and Channel Clearing projects), Ducks Unlimited projects, Irrigation Water Development Assistance Program (since cancelled), and the Major Channel Program. Projects under other programs are only scrutinized if impacts of potential significance are identified by Sask Water. Through exercising its mandate the TAC review process ensures that agricultural, wildlife, fisheries, and environmental interests are adequately addressed and that a project constitutes a benefit to the province.

The TAC has reviewed over 1500 projects being reviewed with general satisfaction by proponents and agencies. In 1995 the province established the Provincial Wetlands Policy which brought a different perspective to the provincial approach to wetlands. The province has an interest in not only trying to protect wetlands but also riparian and upland habitat. The role of the Wetlands Committee and the TAC are under review.

2.2.4 Statutes That Contribute to Wetland Conservation

- THE ECOLOGICAL RESERVES ACT

The intent of this legislation is to preserve designated Crown lands in order to sustain a unique or representative part of the natural environment. The Lt. Governor may make regulations and Orders designating Crown land as an Ecological Reserve and outlining those activities which may take place within the Reserve. This Act takes precedence when in conflict with other Acts.

- THE PARKS ACT

The Parks Act provides the authority for the establishment, maintenance, and use of parks and parklands within the province. This includes protected areas, recreation sites, and/or historic sites. Once established, parkland cannot be granted or transferred, but the Minister may make dispositions subject to reservations. The Lt. Governor may make regulations.

- THE CRITICAL WILDLIFE HABITAT PROTECTION ACT

This legislation provides for the protection and management of Crown lands critical to the maintenance of wildlife populations. Critical wildlife habitat lands are administered in accordance with *The Provincial Lands Act.*, however, no grant or transfer of critical habitat lands is possible. The only exception is a disposition authorized by the Minister or by regulation subject to described terms and procedures.

- THE WILDLIFE ACT, 1997

The main purpose of this Act is for protection of wildlife and species at risk. The Act states that the property in all wildlife within Saskatchewan is vested in the Crown. No person shall acquire any right or property in any wildlife otherwise than in accordance with this Act and regulations.

The Minister may delegate authority and may appoint wildlife officers and deputy wildlife officers. These officers have the power of peace officers to enforce the Act and regulations and are entitled protection pursuant to the Criminal Code.

The Minister administers the Big Game Damage Compensation Fund, which provides compensation to producers for damage or loss by big game. The Minister may enter into agreements with persons, Indian Bands, or Government for:

a) protecting, managing, conserving, reintroducing or encouraging the propagation of wildlife and wild species and protecting, managing and conserving their habitats;
b) establishing and promoting programs respecting public safety, education about wildlife or wild species or other conservation oriented programs; and
c) respecting any matter considered to be necessary by the minister to carry out the provisions of this Act.

Subject to regulations, the Minister may by Order constitute any area of provincial land as a registered trapline district, a fur conservation area, or a fur conservation block. The Minister determines wild species to be at risk, and where the Minister makes this determination the Lt. Governor-in-Council may by regulations designate and list the wild species and exercise prohibitions. There are offence and penalty provisions in the Act. The Lt. Governor-in-Council may make regulations.

- THE ENVIRONMENTAL MANAGEMENT AND PROTECTION ACT (EMPA)

The EMPA is primary legislation governing pollution control in the province. The Act specifically deals with water pollution control, industrial effluent works, sewage works, waterworks, and regulation of all matters concerning water quality. The Minister is empowered, by Order, to have the individual responsible for a pollutant discharge to take necessary measures tp protect or restore the environment. The Minister may take necessary action and recover costs. Individuals, including the Crown, may seek compensation for damages incurred from a pollutant discharge, or for failure in the execution of a duty.

The Act establishes permit requirements, and procedures of permit acquisition for discharge of contaminants which might cause a change in water quality or water pollution. The Act sets out fines for general offences, and most significantly on summary conviction for hazardous material offences and mining industry polluters.

Since 1994, SERM has regulated development around water bodies by means of section 18.1 of EMPA . Section 18.1 refers to activities affecting the bed or bank of a watercourse, and includes removal of material or dumping of material into a water body. Failure of a developer to obtain a permit (shoreland alteration permit) constitutes an offence. Removal of brush and beaver dams are not controlled by section 18.1 of EMPA.

The Lt. Governor may make regulations, i.e. Water Pollution Control Regulations, Water Works Regulations, and Environmental Spill Regulations.

- THE PROVINCIAL LANDS ACT

Crown lands are managed and administered under this legislation. The Minister may transfer provincial lands to any other department for any purpose. Out of every disposition of Crown land, the Crown reserves the property in and right to use of all water powers, and an exclusive or perpetual interest in lands forming the beds and shores of water bodies. Disposition of water is made pursuant to *The Water Corporation Act*. The Lt. Governor-in-Council may set aside

Provincial lands for use as provincial parks, forest reserves, game preserves, bird sanctuaries, public resorts, sites for harbours, piers, bridges etc, treaty land entitlement, or transfer to the government of Canada lands required for any project under the authority of PFRA.

• THE PLANNING AND DEVELOPMENT ACT

The Planning and Development Act provides a municipality with the legal framework necessary to do community planning. The keystone of the planning process is a general policy plan. The Act provides for a Basic Planning Statement and a Development Plan. A zoning by-law must be adopted in conjunction with a policy plan and serves to implement the plan.

The Act allows two or more municipalities to form a Planning District to deal with problems and opportunities that cross municipal boundaries.

Municipalities may exercise some control over water resources through the policy plans and by-laws exercise. This could include:

- . The conservation and improvement of the physical environment.
- . Provision of municipal service and facilities including water and sewage systems.
- . Management and preservation of water storage areas.

An approving authority may require an owner seeking approval for subdivision to provide land for an environmental reserve. The environmental reserve may then be used as a public park or otherwise as specified by the Minister.

• THE CONSERVATION EASEMENTS ACT

This legislation is a tool which can be used by government and other conservation groups to add to the Representative Areas Network, protect game habitat, and facilitate other conservation work in partnership with landowners. Conservation organizations by purchasing such easements can cover the cost of protecting conservation values while the land remains private and can be used for compatible uses such as agriculture.

Amendments to the federal Income Tax Act enable landowners donating easements on ecologically sensitive lands to subtract the value of the easement from taxable income in the year of donation or spread over five years. Conservation easements are registered against lands to ensure environmental protection. The Act is accompanied by administrative regulations.

• THE ENVIRONMENTAL ASSESSMENT ACT

Environmental impact assessment (EIA) is a process which allows for the environmental consequences of a proposal to be fully considered and mitigation identified before commitments are made, and approvals given. Its role is to ensure that decision makers and society at large, particularly those who may be directly or indirectly impacted by the proposal, are fully informed about the potential environmental consequences of development proposals. The assessment process is a centralized project-oriented process where impacts can be identified, delineated, and mitigation proposed according to well defined steps.

The Act authorizes Saskatchewan Environment and Resource Management (SERM) to review the potential environmental effects of a proposed development. The Act says that any project defined as a "development" must be approved by the Minister of SERM before it may proceed. The Act also lays out the process used to determine whether or not a project is a development and provides opportunities for the public to influence government decisions about the project.

If a proposed activity is determined to be a "development" the proponent will be required to complete an environmental impact assessment (EIA) with the results documented in a report called an environmental impact statement (EIS). Public notice is given of the development proposal and draft guidelines developed by SERM for the EIS are available for review. An EIS is reviewed by the assessment technical panel. The EIS and technical comments are released for public review, and may include public meetings. The Minister makes a decision and advises the proponent. Before making a decision the Minister may order a board of inquiry to further assess the development proposal. After receiving the board of inquiry's recommendations, the Minister may approve the project, with or without conditions, or may not allow the development to proceed.

2.3 Manitoba

2.3.1 Statutes That Contribute to Wetland Conservation

- THE ECOLOGICAL RESERVES ACT

The intent of this legislation is to preserve designated Crown lands in order to sustain a unique or representative part of the natural environment. The Act establishes and maintains Ecological Reserves and outlines those activities which may take place within the Reserve

- THE PROVINCIAL PARKS ACT

This act provides the authority to establish lands as provincial parks. In accordance with parks classifications and land use categories, the purpose may be to conserve ecosystems and maintain biodiversity. Regulations have been developed respecting the protection and use of water, interference with drainage patterns and pollution of water.

- THE CROWN LANDS ACT

Crown lands are managed and administered under *The Crown Lands Act*. The Act provides for the sale, lease, permitting, licensing, enforcement and reservations for specific departmental and government programs. In a disposition of Crown land that extends to the shores of any navigable water or an inlet thereof reserves for the Crwon a strip of land one and one-half chains in width measured from ordinary high water mark or from the boundary line. Agricultural disposition of Crown lands is administered by the Department of Agriculture.

- THE WILDLIFE ACT

The Wildlife Act authorizes the Province of Manitoba to designate special areas for the better management, conservation and enhancement of the wildlife resource; stipulate what constitutes an offence; and determine licensing, permit and enforcement provisions. Authorization is required, in the form of a license or permit, to destroy or damage habitat on Crown lands or to wilfully destroy the nest or eggs of any game bird or bird listed in the schedule.

- THE ENDANGERED SPECIES ACT

The Endangered Species Act ensures the protection and enhances the survival of endangered and threatened species and their habitat. The Act prevents the destruction, disturbance or interference of their habitat and the damage, disturbance, obstruction or removal of a natural resource on which an endangered or threatened species depends on for its life and propagation.

- THE WATER RESOURCES ADMINISTRATION ACT

The Water Resources Administration Act establishes the Lieutenant Governor-in-Council's authority to designate any water control work, natural water channel or lake as a provincial waterway. The Minister is authorized to manage and administer all those matters that relate to the construction or operation of water control works and matters dealt with under *The Dyking Authority Act*, *The Ground Water and Water Well Act*, *The Water Power Act*, and *The Water Rights Act*.

This Act also sets out prohibitions of use within designated flood areas. Within designated flood areas, it requires a permit to be issued that authorizes the occupation and construction of buildings, the permit can contain terms and conditions that are consistent with existing and the new proposed "Designated Flood Area Regulation".

- THE PLANNING ACT

The Planning Act provides for the development of Provincial Land Use Policies, establishment of special planning areas and planning districts and provides for the development of basic planning statements, development plans and zoning by-laws. Special planning areas are designated for the protection and conservation of natural resources such as lakes, rivers and shore lands.

- THE HERITAGE RESOURCES ACT

Under *The Heritage Resources Act* sites considered of heritage significance may be designated either as a provincial or municipal heritage site and provided protection through the issuance of a heritage permit or a municipal heritage permit respectively. Within a heritage site, before commencing proposed works, activity, development or project, an application must be submitted for a heritage permit. The proponent may be required to submit a heritage resource impact assessment and/or development plan.

- THE ENVIRONMENT ACT

The intent of *The Environment Act* is to provide for: environmental assessment of projects which are likely to have significant effects on the environment; development and implementation of standards and objectives for environmental quality; and development of environmental management strategies and policies for the protection, maintenance, enhancement and restoration of environmental quality. There are three classes of environmental assessments, dependent on the size of the project, each with its own set of licensing criteria.

Projects in Manitoba may require environmental assessment and licencing according to a process specified in *The Environment Act*. These projects are defined in Manitoba Regulations 164/88. Projects affecting wetlands could be Water Development/Control projects under this regulation, if the following criteria are met:

- Flood Control projects protecting areas greater than one square kilometer.
- Water supply impoundments greater than 50 cubic decameters. This includes water supply impoundments for wildlife and fisheries habitat enhancement.
- Land drainage projects draining areas greater than 50 square kilometers.
- Works resulting in modification to lake or river levels and affecting a water surface area of greater than two square kilometers. This includes wetland surface areas.
- Alteration to stream channels which affect fish mobility and fish habitat. This includes lake and wetland areas which contain fish.
- Withdrawal of water from any body of water greater than 200 cubic decameters/year.

2.4 Local Governments

2.4.1 Saskatchewan Municipal Government

- THE URBAN MUNICIPALITIES ACT

A council may make by-laws for the health and prevention of the spread of communicable disease, including prohibition or regulation of bathing/washing in public waters. Council can create by-laws that provide for the collection, removal, or disposal of solid wastes. Council can make by-laws controlling the use of water supply, providing water, regulating use and preventing contamination of any stream or water flowing through or past an urban municipality. Council can establish works for supply, collection, treatment, storage, and distribution of water, and collection, transmission, storage, treatment and disposal of sewage or storm drainage. There are penalties for violation of any by-laws passed.

Urban Municipalities - Urban development and subdivision expansion have resulted in loss of wetlands within and adjacent to urban boundaries. Each urban municipality has the responsibility to develop and maintain infrastructure to support the residential, commercial, recreational and industrial needs of the community. Urban municipalities develop, maintain, and enhance riparian and parkland zones, however, wetland conservation strategies are usually not practiced. With increasing frequency urban planners and developers are incorporating storm sewer retention ponds into subdivision developments. Existing wetlands are retained or modified, or new catchments are constructed and suitably landscaped. The wetland functions of these catchments attenuate flood water, trap silt, improve water quality, and provide an aesthetically pleasing landscape.

- THE RURAL MUNICIPALITIES ACT

Rural municipal councils may make grants to the installer of sewer or water systems for residents of hamlets, provide for and regulate supply of waters to the municipalities, and enter into contracts with Sask Power for power generating or distribution. Council can construct any drains it may consider necessary and can remove obstructions in drains. A council may regulate waste disposal sites, and provide for the cleaning up of the foreshore of any lake within the municipality and constructing pathways, even if the municipality does not own the foreshore (subject to the rights of the owner). Council may declare a drain, ditch, watercourse, pond, surface water or any other matter/thing in or on private land a nuisance and dangerous to the public safety or health. Council can order that the nuisance be removed or otherwise dealt with, and upon non compliance by the owner or occupant undertake the work and recover costs as an added tax to the land.

The Rural Municipal Act allows council to establish and operate public utilities (e.g. rural water pipeline). Council may delegate powers to a utility board. As a legal entity, a utility board can pass by-laws, enter into agreements and borrow money. Council may pass by-laws for imposing daily or maximum fines for breach of any of the municipalities by-laws

Rural Municipalities - The primary responsibility of rural municipalities is to develop and maintain their road transportation infrastructure. Right-of-way management practices currently support the removal of adjoining water bodies which often contribute to the degradation and softening of road beds and increase maintenance costs. The priority of rural municipal councils to develop and maintain a safe transportation network has taken precedence over wetland conservation strategies and initiatives. Roadside municipal drainage ditches which intercept and convey natural flows, and flow from private drainage, play a significant role in rural water management, impact to wetlands, and consequential flooding of downstream infrastructure and property.

2.4.2 Manitoba Municipal Government

THE MUNICIPAL ACT

The Municipal Act provides for the formation of a municipality, its council and the jurisdiction under which it governs. With respect to water, a municipality may pass by-laws regarding drains and drainage on private or public property.

2.5 Other Local Governments

2.5.1 Saskatchewan

- CONSERVATION AND DEVELOPMENT AREAS

Earlier drainage districts legislation was replaced by *The Conservation and Development Act(1949)* which through landowner petitioning allows the creation of a Conservation and Development Area (C&D Areas). These have concentrated on construction of drainage projects, with government assistance as a form of land development particularly in the northeast and east central areas of the province. The Conservation Area Authorities construct, operate, and maintain flood control and drainage projects for the benefit of agricultural land. Some projects are multi-purpose in nature which incorporate wetland conservation, lake stabilization, and enhance and protect associated habitats. Within the Upper Assiniboine River Basin there are currently nine C&D Areas responsible for the operation and maintenance of 285 km of works.

- WATERSHED ASSOCIATIONS

A Watershed Association (WSA) is established by Order-in-Council subsequent to voluntary application by eligible agencies. A governing board is comprised of appointed representatives from each member agency. Watershed association boards, with government assistance and other partnering, can plan, construct, alter, improve, operate, and maintain projects for the purpose of storing, conserving, protecting, and developing the water resource available to the association. The WSA's mandate extends to conserve, control, protect and develop land, forest, recreational resources, fish and wildlife habitat. A watershed association is a means for various organizations, often with opposing or conflicting needs to come together to resolve land and water issues. In the Upper Assiniboine River Basin there are currently four watershed associations responsible for the operation and maintenance of 63 km of works and one lake stabilization structure (Good Spirit Lake).

2.5.2 Manitoba

- CONSERVATION DISTRICTS

The province establishes Conservation Districts to sponsor, resource conservation initiatives within a watershed. Conservation Districts are encouraged by the province but are locally requested. A district is a form of government charged with managing all resources that influence water within the watershed. Each District is divided into a number of sub-watersheds each governed by a committee of representatives from rural and urban municipalities. The chairpersons of the sub-watersheds form the main governing board of the conservation district. The board must prepare a basin management plan stating priorities and issues requiring attention. The plan must include a five year financial plan. To carry out the approved plan, the board:

- may have jurisdiction over manmade waterways
- may enter into agreements with landowners and other agencies
- may construct and operate works such as dams and drains
- can provide financial incentives
- can buy and sell land
- can ask member municipalities to pass bylaws supporting board objectives

The boards set levies for member municipalities. This revenue is used to lever provincial grant funding on a 75 percent provincial, 25 percent municipal cost share basis. The funding is used for administration, technical studies, and program implementation. The districts can obtain other funding sources to add to their annual project budgets.

Conservation districts design and deliver projects to suit local needs. Projects are watershed based and cover a broad spectrum of soil, water, wildlife, fisheries, recreation, heritage and education programs. Projects can deal with water control, water quality, drainage, flood control, water storage and management, erosion and soil programs, water recreation, domestic water supplies, environmental issues, fisheries, wildlife habitat, wetlands, shelterbelts, forestry and eco-tourism. Board staff are responsible for project planning, implementation, and evaluation.

Manitoba's Conservation Districts have practiced sustainable development at the grass roots level. Many resource interest groups now recognize Conservation districts as leaders in resource management, and see them as ideal organizations through which to implement cooperative resource management ventures.

3 Conservation Organizations

Introduction

Conservation organizations play a vital role in all aspects pertaining to wetland conservation. Although these agencies have no legislative powers, they have influenced government in the determination of policies and legislation affecting wetland habitat. The public is kept aware of wetland and waterfowl issues by these organization's communication strategies. Conservation organizations have secured thousands of acres of wetland habitat through a variety of programs. Often these efforts are in conjunction with government initiatives.

The following are conservation organizations which through their objectives and activities can, and likely have, influenced wetland conservation and management in the Upper Assiniboine River Basin. A brief description of the wetland habitat programs offered by these agencies is provided.

3.1 Ducks Unlimited Canada

Ducks Unlimited Canada is a private, not-for-profit organization whose mission is to conserve wetlands and associated habitats for the benefit of North America's waterfowl, and in turn provide healthy environments for wildlife and people. The majority of DU's conservation activity is focussed on the Prairie Pothole Region (PPR) of western Canada, the most productive landscape for waterfowl production in North America. DU's long term vision for the PPR is to develop a mosaic of natural, restored and managed landscapes capable of perpetually sustaining populations of waterfowl and other wildlife. Historically, Ducks Unlimited projects focussed on water control developments for medium to large sized wetlands, beginning in 1938. Land for these projects was secured through an easement program where the landowner derived benefits such as flood control, improved crossings and access in exchange for giving a flood easement to Ducks Unlimited.

The Saskatchewan Heritage Marsh Program began in the early 1980s. The focus was on large wetland complexes of regional or provincial significance. Some of the marshes developed were Ponass Lake, Foam Lake, Ranch Lake, Thunder Creek, Chaplin Lake, Luck Lake and Ranch Lake. To secure the project some lands were purchased and some were provincial Crown land. Title for land purchased by DU or others was held by the Saskatchewan Wildlife Federation because DU's policy was not to own land. Partners with DU in this program included Saskatchewan Wildlife Federation, Nature Saskatchewan, Habitat Canada and the provincial government.

A Waterfowl Damage Compensation and Prevention Program was an important component of the Saskatchewan Heritage Marsh Agreement. This included establishing lure crops and constructing waterfowl damage prevention sites. Funding for compensation was to be shared by the federal and provincial governments. Saskatchewan Crop Insurance was to administer the program. Lack of funding resulted in many landowners complaining about damage from waterfowl. More recently a compensation program with compensation set at 80 percent of damage was implemented to help address landowners' concerns.

By the 1980s, wildlife ecologists realized that small wetland complexes (potholes) and native upland habitat were quickly disappearing in western Canada. Analysis has revealed that some parts of the PPR have suffered losses of native habitat in excess of 70 percent since settlement. In the PPR, the cropland base has increased by 30 percent in the last 25 years with a subsequent loss of 5.9 million acres of natural land. Coupled with wetland drainage and drought this had a severe negative impact on waterfowl populations. To address these problems, DU became a partner in the North American Waterfowl Management Plan (NAWMP) and shifted its focus from large wetlands and engineered systems towards small wetlands in areas with high densities of potholes. Emphasis was placed on developing nesting cover or upland habitat in these areas through cooperative programs with farmers. Priority areas were selected that had the best waterfowl habitat. These became the target areas for programs under the NAWMP. Saskatchewan Wetland Conservation Corporation administers the NAWMP and DU is the primary delivery arm at the field level.

As part of the NAWMP, programs include lease and purchase of wetland and waterfowl habitat land within a target region. These lands are managed to increase waterfowl production. DU changed its policy so that it could purchase and hold title to land. This was seen as a way to demonstrate to contributors to the NAWMP programs the long term security of habitat. Other programs include agricultural demonstrations that promote soil and water conservation which are wildlife friendly such as winter wheat planting, Timothy grass production, zero till practices, grazing techniques and chemfallow. Other management practices include use of flushing bars to flush birds and other wildlife ahead of field equipment, delaying hay cut until after mid July to enable greater fledgling success, and improved grazing management. The objective is to have agricultural use of the land at the same time as developing wildlife friendly management practices which are economically sound. DU provides both financial and technical assistance in these programs.

DU is very active in areas of agricultural research and agriculture extension. To date, NAWMP extension efforts conducted by DU within the UARB have totaled approximately $250,000. DU's extension activities include research, promotion, demonstration and education on topics including: fall cereal production, forage production, beef production, minimal tillage, wildlife flushing bars, and native plant materials development.

Recent endeavours include DU's establishment of the Eco-Agriculture Enhancement Chair in the Crop Development Centre Department of Plant Sciences at the University of Saskatchewan. The goal of this chair is to lead research teams to develop economically sustainable, environmentally friendly farming systems for the Northern Great Plains region. In 1998, DU committed $500,000 to the chair for five years. DU agrologists and biologists are also partnering with agricultural agencies such as SAF, PFRA, MA, local ADD Boards, AFAC, producer clubs, and First Nations people to deliver research and extension initiatives that benefit farmers and the environment. The research is targeted specifically to the Northern Great Plains region. Current examples within the Upper Assiniboine River Basin include the formation of producer beef clubs, the funding and development of the Winter Wheat Production Manual, in partnership with the U of S and Winter Cereals Canada, and Timothy production research plots in RM of Churchbridge. In addition, the University of Saskatchewan Centre for Crop Development is making progress towards developing new varieties of winter wheat that will be well suited to western Canada.

3.2 Saskatchewan Wildlife Federation

The Saskatchewan Wildlife Federation (SWF) is a non-profit, non-government, charitable organization of over 30,000 members representing every walk of life; 140 local branches are affiliated with the provincial body, which in turn is affiliated with the Canadian Wildlife Federation. As a provincial organization it is committed to the wise use and management of our natural resources.. The SWF works with organizations like Ducks Unlimited Canada, Nature Saskatchewan, Sask Wetland Conservation Corporation, and fish and wildlife branches of the provincial government. The SWF initiated the Fish and Wildlife Development Fund.

Habitat Programs of the Saskatchewan Wildlife Federation:

Wildlife Tomorrow: This program's purpose is to preserve habitat in its natural state for all species of wildlife. Signs are erected to recognize landowners who support this initiative by setting aside a few acres of their farmland (slough, bush, native prairie, margin land, pasture). No transfer of title is required. This may also include abandoned farmsteads, undeveloped road allowances, heritage schoolyards, and heritage sites. The SWF holds agreements in excess of 300,000 acres of wildlife habitat on private lands across Saskatchewan.

Habitat Trust: A special fund was established in 1978 for the purchase, retention, and enhancement of critical habitat across the province. Money is raised by tax deductible donations and fund raising events.

Fisheries: SWF branches conduct/establish local fisheries projects in conjunction with the provincial government's Fish and Wildlife Development Fund.

3.3 Nature Conservancy Canada

The Nature Conservancy of Canada (NCC) is a national, non-profit organization incorporated in 1962. As a registered charity, NCC issues receipts for tax-creditable donations of cash, land or other assets it receives. A board of trustees comprised of scientists, lawyers, business people, financial experts and other individuals governs the policies and overall activities of NCC.

The Nature Conservancy of Canada is a national organization dedicated to preserving areas of Canadian biodiversity for their intrinsic value and for the benefit of future generations. To accomplish this mission, the NCC secures ecologically significant natural areas, and places of special beauty and/or educational interest through purchase, donations, conservation agreements, or other mechanisms.

Since its inception, NCC has worked with conservation partners and concerned individuals to secure more than 800 properties, protecting over 600,000 hectares across the country. NCC has protected endangered coastal wetlands, prairie grasslands, swamps and woodlands through partnerships forged with individuals, community groups, corporations, foundations and governments. Many of the nature preserves also provide critical habitat for our country's imperilled and rare plants and animals.

To ensure the long-term protection of properties secured by NCC, the organization develops improved arrangements for property management, stewardship and monitoring. These are achieved in part by developing a systematic approach to involve and support local and regional groups, as well as individual volunteers to carry out this aspect of NCC's work. A core of organizations and volunteers is actively involved in the management and monitoring of sites and management plans are completed where necessary for sites in which NCC has a legal interest.

Conservation easement legislation has made it possible for NCC to hold an interest in ecologically significant lands across the country for their long term conservation while allowing the landowner to continue current land uses of the property which do not adversely affect the natural habitats of the property. Monitoring of these easements ensures that the restrictions placed on the property are adhered to.

3.4 Nature Saskatchewan

Founded in 1949, Nature Saskatchewan is a volunteer, non-profit society with over 2,000 members and 12 local societies. Their mission is to promote appreciation and understanding the natural environment through education, conservation, and research, to protect and preserve natural ecosystems and their biodiversity.

Habitat Programs:

- Co-sponsor the "living by water project", a stewardship program for maintaining shoreline habitat.

- An eligible agency to accept and negotiate Conservation Easements.

- With landowner cooperation protects approximately 40,000 hectares of grassland habitat through Operation Burrowing Owl

- Conduct province-wide population surveys of over 15 species and spaces at risk.

- Co-manage the Saskatchewan Conservation Data Centre.

- Owns and maintains six nature sanctuaries.

- Co-sponsor educational and research activities at Last Mountain Bird Observatory.

- Provide member funding for research and conservation projects

- Partnership with the Canadian Nature Federation and Bird Studies Canada

3.5 Lake Stewardship

- THE NORTH AMERICAN LAKE MANAGEMENT SOCIETY

The North American Lake Management Society's (NALMS) mission is to promote the understanding of lakes, ponds, reservoirs, and their watersheds; the ecosystems of which they are a part; and their protection, management, and restoration. The society's constitution allows the formation of state, provincial, or regional chapters with the same purpose and objectives of the umbrella organization. Chapters develop rules and procedures that best suit their area and members. Some chapters are made up of different lake associations, while others are based on individual members. Chapter organizations have access, via NALMS, to scientists, professionals, and other lake users, to help find solutions to local water quality problems.

- LAKE STEWARDSHIP GROUPS

The activities of stewardship groups are based on the concept of collecting useful data, providing a forum to share information, educating members and the public; and assisting in the development of lake protection and enhancement projects. Organizations actively collect water quality data, assess health of riparian habitat on streams entering lakes, publish newsletters, hold workshops, organize educational walks, and work with agricultural producers to protect riparian areas.

With assistance, direction, and coordination from Sask Water, two charter organizations were established in 1998; Friends of Good Spirit Lake, and Stewards of Jackfish and Murray Lakes.

In January, 1999 Sask Water announced signing agreements with the administration boards of The Friends of Good Spirit Lake and The Stewards of Jackfish and Murray Lakes. Beyond a funding commitment over three years Sask Water will also provide technical and administrative assistance to initiate operations of the two organizations.

Good Spirit Lake is located in the Upper Assiniboine River Basin approximately 60 km northeast of Yorkton. The Friends of Good Spirit Lake stewardship group membership consists of four resort communities, The RM of Good Lake, The Good Spirit Lake Watershed Association, and 19 individuals. The stewardship group's primary activities will include collection of water quality data, sharing acquired information, educating the public on matters of sound lake and watershed management, fostering partnerships with government and research personnel, and developing lake enhancement and protection sites.

4 Landowners' Perspectives

Many landowners believe the costs to conserve and protect wetlands are largely born by private landowners even though wetlands benefit all of society. Although landowners often do not receive direct or monetary benefits for maintaining wetlands, they nonetheless absorb the costs of their preservation.

The land management decisions made by each landowner are site specific and depend on the individual's land use priorities. Within the agricultural community, wetlands are often viewed as a hindrance to farming operations. As a result wetland basins and their margins may be drained, filled in, tilled, grazed, or burned. Today's farm operator is in a difficult position. He/she is subjected to many forces including cultural, economic, global, political, and climactic which affect farming practices. Farming practices have been reinforced over several generations by a society that has encouraged farmers to pursue production goals for societal good, often to the detriment of the environment. Landowners are faced with adopting new approaches to farming in response to society's interest in maintaining a healthy landscape.

Landowners are by large prudent stewards of the land and with increasing frequency use land use practices which retain or enhance wetlands and wetland margins for the benefits they derive. Landowners have a major role in determinig whether wetlands on their land will be drained or altered.

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